Analysis of the RPA's Updated Detailed Business Case for Metro North

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1. Summary

The RPA's updated Detailed Business Case for Metro North is the third in the series. The analysis makes a strong case for Metro North contending that, in a Moderate Growth scenario, it yields a benefit to cost ratio of 1.5:1, which is further increased to 2:1 if wider impacts are counted. The report, like the previous two is only available in heavily redacted form, obstructing our ability to examine its claims.

The Cost-to-Benefit claims are somewhat surprising in that the first report gave very poor results for the option of a Metro to Swords from Dublin City Centre. One would have expected, given the less favourable economic outlook now, and reduced expectations for future growth in passenger numbers, results should not be getting dramatically better. The RPA claims Metro North is viable even under a No Growth assumption, which seems even more improbable. We can examine this option because of its simpler assumptions and can reconstruct a simple Cost Benefit Analysis model of it.

When we test the RPA's No Growth scenario for omissions in the analysis, we find that the claimed result does not stand up. One serious omission was the 50% penalty the Department of Finance insists should be applied when public funds are spent, in order to account for the economic distortions created by raising taxes. After applying sensitivity tests, (the three tests are outlined in detail in this document) the Benefit to Cost Ratio for the Metro North project halved to 0.52, suggesting that its benefits are approximately half of its costs. We also note what appears to be a double counting of benefits with the addition of fare revenue to user benefits.

By extrapolation, the other scenarios, including the central case with moderate growth assumptions, are probably similarly weak and unlikely to stand up to close scrutiny.

We also note that the report fails (as did its predecessors) to deal properly with real alternatives to Metro North such as a very low capital cost Bus Rapid Transit system using the Port Tunnel and M1 to serve Dublin Airport and Swords, which could be extended to serve other population centres. It is a requirement of government appraisal guidelines that a number of options be analysed with the same rigour, rather than just the preferred option, but it is blatantly clear that only metro was assessed: in other words, stated policy has been contravened.

It is also quite striking that about one-third of Metro North passengers will be taken from existing bus routes. The DBC admits that 14 million bus passengers will be lost to Metro North each year while car trips will be reduced by only 12 million annually. That, plus the loss of pedestrians (which does not appear to have been quantified), does not seem to be a very positive environmental outcome.

We also point out that the lack of transparency which is evident in the redaction of analysis results has very serious implications for good governance as it allows poor management of our public resources to continue. Analysis by project promoters is not acceptable. Only fully independent analysis and full reporting of results will ensure the improved governance now so vital for our future prosperity.

2. Introduction

My name is Matthew Harley. I am a graduate engineer (UCD) and hold a Master's degree in economic analysis (TCD). I have 25 years experience as an economist (policy analyst) across public governance organisations such as the OECD in Paris and government departments in Ireland, including the Department of Finance.

The Railway Procurement Agency (RPA) has released an Updated Detailed Business Case (DBC) for Metro North dated July 2010. It is available online in heavily redacted form.[1] This Detailed Business Case is the third in a series of business case reports on Metro North, sponsored by the RPA. An Outline Business Case (OBC) was prepared by Steer Davies Gleave for the RPA and presented to Government in November 2002. A Revised Business Case (RBC) also by Steer Davies Gleave, replaced the Outline Business Case, and was presented to Government seven months later in June 2003. Heavily redacted versions of the OBC and RBC are available online on the Transport 21 website.[2,3]

The RBC was the report used by O'Reilly Consultants to prepare a report for the Joint Oireachtas Committee in May 2004. The O'Reilly report cited a Benefit to Cost Ratio (BCR) of 1.31:1 for a Metro from Dublin City Centre to Dublin Airport, the only option analysed in the RBC. The O'Reilly report did not mention that when corrections requested by the NDP/CSF Evaluation Unit of the Department of Finance were applied, the BCR fell back to a breakeven 1.01. These corrections included a surcharge for the use of public funds, which was then 25%. It is now 50%. None of

these reports dealt with the current 18 km proposal for a Metro between Saint Stephens Green and Bellinstown.

On 28 October 2010, An Bord Pleanála approved Metro North but cut the last three northern stops, shortening the route by 2.3 km. A Final Business Case will have to be prepared before government approval in order to reflect these and other design changes and updated economic conditions. We must confine our comments to the latest report available, the DBC.

3. Detailed Business Case (DBC), July 2010

The DBC analyses the full 18 km Metro North line to Belinstown. Its main conclusion is that, under a Base Case[4] (Moderate Growth) assumption, the BCR is 1.55:1 and the Internal Rate of Return (IRR) is 9.1%. When "Wider Impacts" are added the BCR rises to 2:1 and the IRR to 13%. This result underlies the assertion by Metro advocates that "for every euro invested in Metro North we get back two".

These appear to be impressive results but clash sharply with the earlier reports, especially the OBC. It found that the Dublin City Centre (DCC) to Swords option (the nearest to the current proposal) had a BCR of only 0.65, which, when corrected by the Department of Finance, fell to 0.48. This is essentially the option we are now told scores a BCR of 1.55. The option stopping at Dublin Airport had a BCR of 0.49 in the OBC. It dropped to 0.36 when the Finance corrections were applied. Magically, it jumped from there to a breakeven 1.01 in the RBC (with the Dept. of Finance corrections) and from 0.49 to 1.31 (without corrections); a 170% improvement.

The main reason for the dramatic improvement over seven months between the OBC and RBC was the updating of the model used, to incorporate the dramatically improved outlook determined by the Celtic Tiger.[5] We would expect that in the light of our current economic condition and depressed outlook, a new assessment would look more like the earlier OBC results. It is surprising to see the optimistic assessment of the RBC emerging again. We have to question such results. We are, however, severely limited by the redacted and often obscure nature of the DBC.

4. Bus Rapid Transport System Alternative

We questioned the optimistic results of the RBC in our submission on behalf of An Taisce to the Oral Hearing on Metro North, which started on 1 April 2009.[6] Our analysis demonstrated that, if more recent trends were taken into account in a new analysis, it was very unlikely that the Metro North proposal would prove to be a viable option.

We also pointed out that it was not sufficient for a proposal to pass the minimum rate of return test (an IRR of 4%). According to Government Capital Appraisal Guidelines the proposal had to be shown to be the best alternative for the purpose. We showed that however well Metro North might score, a Bus Rapid Transit (BRT)

line using the Port Tunnel and M1 to link the City Centre to Dublin Airport and Swords would be much superior, essentially because of its very modest capital costs, which still delivered up to two-thirds of the benefits claimed by Metro North. A French style BRT upgrade of the Ballymun QBC could serve Drumcondra, DCU, Ballymun and the Airport via the M1, also at low cost.[7] That remains our position, to the extent that if our doubts were relieved and the DBC results were confirmed we would still require that Metro North be shown to be a better option than alternatives, such as the BRT Port Tunnel/M1 option.

The DBC recognises that buses using the Port Tunnel would be competitive with Metro North in journey times but claims its weakness is a lack of pickup/drop-off opportunities. It also acknowledges high capacity BRT systems but rules one out as an alternative to Metro North on the grounds that it would occupy road space.[8] (One wonders why this argument did not apply to Luas). It fails to make the obvious deduction that a BRT system using the Port Tunnel and the M1 would not have this problem for most of its route.

In Dublin City it could use the Luas corridor to the Point. While a Port Tunnel BRT would miss some Metro North passenger options, it could also add patronage. There is the prospect of providing the 40,000 employees and 22,000 residents of the Docklands area, including the Point Village with a 15-minute link with Dublin Airport. The area already has a daytime population greater than that of Swords, and has growth prospects at least as good. Such a service could also link to the new Docklands main line station at Spencer Dock serving the Maynooth line. The DBC does not quantify any net loss of passengers by the BRT Tunnel option; it merely asserts that there would be such a loss. We estimated a loss of about one third of passengers (without adding prospects for new patronage in the Docklands) but pointed out that the economic gains were so large that it should be considered before Metro North. If Metro North can later prove its potential viability while competing with a BRT system in place, it could be constructed, perhaps in better economic times. Note also that a BRT system using the Port Tunnel/M1 could be put in place very quickly with minimal disruption to Dublin City business and traffic.

5. Bus trips lost to Metro North

In evidence to the Oral Hearing by Mr David King, presented by Mr Rory O'Connor on 29 April 2009, it was claimed that, according to the RPA's (then) indicative forecasts, Metro North would add 45.6 million trips to the Metro network. However, there would be a corresponding decrease in bus trips of about 16.3 million due to bus users transferring to Metro North from parallel bus routes. That is 36% of the expected Metro trip impact. This is a staggering admission that Metro North will have a huge detrimental effect on more environmentally positive bus usage. The impact is supposed to be appeased by the suggestion that "bus services would be rearranged". We have to presume therefore that bus services will be expanded on routes where they are not currently viable.

The DBC acknowledges the loss of bus passengers but makes the same excuse that the bus network could be reorganised. We are told that in the Base Case (Moderate

Growth) scenario car trips will be reduced by 11.8 million per annum. If 36% of the 36.3 million Metro passengers are taken from existing bus routes we lose 13 million bus passenger trips per annum. In fact, the DBC acknowledges a loss of 14 million per annum (DBC 4.4.2). The loss of bus trips is forgotten when the DBC claims that the 12 million fewer car trips per annum will generate significant environmental benefits (DBC 1.3). We may also presume that Metro North will divert significant numbers of pedestrians onto its services. It is not obvious that there will be much of a net gain for the environment. We need to see a quantification of the net effect on emissions and a value put on that net result.

6. Our Test Model

We might be able to construct a simple CBA model to test the claims made by the RPA in the DBC. A very large proportion of benefits (without considering so-called Wider Impacts) derive from the time saved by passengers. Other benefits include time saved by other commuters due to reduced congestion, fewer road accidents, net reduced emissions, etc. For simplicity (we do not have the information) we will assume all benefits derive from time saved by Metro passengers, which will dominate benefits. A critical variable is therefore the pattern of passenger demand, or patronage, over time. Do we have it?

The DBC, for all the faults mentioned, is a better piece of work to the earlier OBC and RBC. In particular, it avoids taking only the most optimistic outlook. For example, its Base Case (Moderate Growth) scenario does not assume the Local Authority projected High Growth estimates, nor does it assume all Transport 21 projects are completed, as was the case in the OBC and RBC. It does not assume Metro West or the Luas Broombrige will be delivered (in the Base Case). These options are however examined by the DBC in additional sensitivity tests.

However, the DBC doubles the catchment area for Metro North by extending the Metro North Economic Corridor from 500 meters around the Metro North trajectory to 1km, an assumed "acceptable walking distance". This doubles population and employment catchment figures from the earlier OBC and RBC reports. It is not clear how this device affects the DBC's Metro North patronage assumptions. Mr David King of the RPA gave a starting figure of 40 million to the Oral Hearing in April 2009. The DBC does not give a staring figure but we deduce that will be about 20 million passengers per annum in 2017.[9] The DBC is therefore rather modest, as 20 million is only half the 40 million given by the RPA to the Oral Hearing.

Twenty million passengers per annum in the first year, 2017, may be conservative. However, we wonder what the basis of these patronage estimates is. What are the assumptions used to arrive at estimates? As mentioned, the RPA defended an estimate of 40 million passengers in the first year of operation at the recent Oral Hearing. This estimate has now halved. We are given no explanation for this radical change but are now asked to take it again on faith that the most recent estimates are reliable.

Although this patronage data is not redacted (blacked out) in the DBC the annual pattern of demand is very obscure and even non-existent, except perhaps for the No Growth scenario.

The year 2025 (sometimes 2026) is taken to be the "forecast year". It is not clear how forecasts for that year are applied to other years before and after, if indeed they are. As the analysis assumes a thirty-year lifetime for the project beginning in 2017 after construction, we expect to see annual patronage figures from 2017 to 2046/7, for each scenario. We do not see such figures, but only estimates for one year, assumed to be 2025/2026. There are a number of statements that suggest that the figures from just one forecast year are used in the analysis of total lifetime benefits:

> "The RPA multi-modal transport model has been applied to develop forecasts of patronage, user and non-user time benefits and revenue for 2026 as a result of Metro North. These outputs were then monetised, discounted and summarised according to the economic appraisal methodology and compared with the full discounted costs of the scheme over a thirty year appraisal period to assess the economic worth of the project."

We also have: "The Base Case test forecasts patronage for the future forecast year of 2025." And: "In the Base Case scenario Metro North is forecast to have 36.3 million boardings annually." The term "annually" implies the same value is used for more than one year.

This suggests that only one year (2025 or 2026) is used as a "forecast year" with all analysis of benefits based on the figures for that year. This is a very odd approach. At the same time we see references to passenger loads changing over time, as we would expect. Table 4.7 for example shows a Local Authority (High Growth) estimate of the peak flow in 2025 of 11,180 (passengers per hour) growing to 17,520 in 2047. We are also told capacity will increase from 8,000 passengers per direction per hour to 20,000 (dates not specified).

7. The No Growth in Patronage Scenario

The No Growth scenario should be relatively easy to simulate. Testing the No Growth scenario against reported results should will indicate how robust the analysis has been for that scenario and help confirm some of the key undisclosed assumptions made by the RPA that we have to deduce.

This No Growth scenario, based on no population growth since the 2006 Census, gives an annual passenger load of 25.1 million. We would assume that no growth in population or employment means no change in patronage over the lifetime of the project (although this is not stated in the DBC). However, there is one problem; the text says:

> "Economic appraisal demonstrates that the business case for the project is resilient and retains its economic value-for-money under a range of different scenarios, even assuming the most pessimistic demographic scenario of no

> growth in population or employment between 2006 and the forecast year of 2026."

The 2026 limit is ignored elsewhere in the text where we find:

> "Sensitivity testing demonstrates that the economic case for the scheme is resilient and retains its economic value for money even when adopting the most pessimistic demographic assumption of no growth in population and employment beyond 2006."

This language seems to confirm that only figures for the forecast year 2025 (or 2026) are used in the analysis, which is very odd and not consistent with standard methodology. What is assumed for the years before and after the "forecast year"? How could it make sense to apply the forecast for one year to all years in all scenarios (except for the No Growth scenario)? Surely patronage must change year-to-year.

For our model we need patronage numbers from 2017 out to 2047. As the spirit of the scenario is "no growth" we will assume "no growth" persists for the lifetime of the project (to 2047). It is assumed to ramp up over 4 years starting at 20 million in 2017 when the line opens (as suggested in Table 8.6). We have elsewhere deduced that passenger numbers in 2017 are expected to be about 20 million.

7.1 Other variables – construction costs.

We estimate capital construction costs will be €2.8 billion. Minister Eamon Ryan said construction costs would be between €2.5 and €3 billion on RTE's Prime Time on 21 October 2010. Business and Finance in its November 2010 issue reported that contractor bidding was around €2.8 billion.[10] In our submission to An Bord Pleanála we estimated a basic capital cost of €3 billion. Although some capital costs have already been incurred, we assumed €560 million in each year from 2012 to 2016.[11]

7.2 Other variables – time saved

The average time saved per trip is estimated at 20 minutes. This figure is not given by the DBC but two examples are given, namely a saving of 25 minutes from Swords to Dublin City and a saving of 11 minutes from Ballymun to Dublin City. The average cannot be more than 25 minutes or less than 11, as the bulk of passengers (southbound) board around Swords. We assume the average time saved will be about 20 minutes.

The value of time saved is given by the Department of Transport guidelines, The Common Appraisal Framework (CAF), for the year 2002.[12] These figures need to be revised. Given an assumed mix of 75% business/non-business travel we have estimated a value of €21 per hour in 2009 terms, allowing for real economic growth between 2002 and 2009. This gives an average (social) value per trip of €7.00 in 2009 values.

7.3 Other variables – real growth impact on value of time.

The OBC and RBC assumed that the value of time grows with economic growth. It may not make much sense to assume we have real economic growth but no growth in population or patronage. However we will assume the same economic growth assumption and its impact on the value of time was made by the DBC for all scenarios, including the presumed "no growth" in patronage scenario. There is no explicit mention of this in the DBC but there are figures for growth in Appendix 3 of the CAF guidelines (dated June 2009). These are based on GNP per person employed, so should reflect real wage growth. Given the recent economic turmoil we first assume no growth in 2010. We assume the RPA used the CAF guidelines of 2.37% for 2011 to 2015, and 2.29% for every year from 2016 on. It should be noted that, when it recommended adjustments to the OBC, the Department of Finance recommended a 2.45% growth rate rather than the RPA's then assumed 3% from 2010 on, based on expected growth in real wages. It might be expected that Finance would now recommended a lower figure than CAF's longer-term 2.29%.

7.4 Other Variables – Operating Costs

The RPA will pay the Operating Contractor an operating fee and pay the PPP Contractor an additional cost of energy charge. If passenger revenue exceeds the operating fee the surplus must be paid back to the RPA. In the contract, these payments appear to be treated on an aggregate basis rather than on a per passenger basis but we must work with per passenger figures.

We have worked out an energy charge of about €0.30 per average journey.[13] To come to a total operating charge per passenger we find that operating costs are about €3.20 per passenger in the Paris Metro and €4 in the London Underground. The limited scope for economies of scale on the Dublin Metro North line and higher wage rates would suggest even higher costs are likely in Dublin. However, we assume an intermediate operating cost of €3.50 per passenger. This suggests the operating fee needs to be about €3.20 (as the €0.30 energy charge is paid for separately) and the fee of €3.20 will mean a top-up of €1 per passenger on the fare (€2.20) and the energy payment (€0.30). As we see later, we need to keep fare revenue separate from other payments covering operating costs.

In addition to fare revenue, revenue includes other revenue (e.g. parking, advertising and other commercial revenue) but we have almost no information about that. It is said that total revenue is assumed to cover and energy payments and the operating fee but we cannot simulate that without the details. It may mean that the top up of €1.00 we estimate will be needed may be got from other commercial revenues, but we just don't know.

If the value of time saved is assumed to grow with GNP per employee, ongoing costs should also grow similarly, not least because operating costs will be heavily influenced by growing real wage rates. As we assume the RPA did not do this, we will do so later as a sensitivity test, when we will apply the same growth factors to operating costs and capital renewal/replacement costs.

7.5 Other variables – capital renewal

Capital renewal is mentioned in the DBC but all figures have been omitted. From a perusal of some large mass transport systems, which include tunnels, we deduce that about a 2% capital renewal per annum rate might apply.[14] We therefore charge 2% of the initial construction cost of €2.8 billion per annum. This is conservative, as a high rate of annual renewal is implied by the assumption that the residual value of the project was the full initial construction cost. We assume the RPA followed the CAF's advice and made this assumption (see 8 below). It would be expected that renewal expenditure will not follow a straight line 2% per annum, and is likely to be bunched in later years. However, given the total absence of data in the DBC we will make that simplifying assumption. It is assumed that capital renewal costs are not included in unit operating costs as determined above. We are not sure what assumption the RPA made in this regard.

7.6 Other variable – test discount rate.

The discount rate to be applied in Cost Benefit Analysis is based on the concept of a Social Time Preference Rate (STPR) or the value society places on current over future consumption. The UK's Green Book discusses this concept.[15] The Department of Finance's reference rate, the "Test Discount Rate", was reduced in 2007 from 5% to 4%.[16] One might have expected that with current high government borrowing costs that reference rate should be increased, but it appears not. A recent circular, says it is still 4% for CBA.[17] It may reflect the view that the STPR is not much affected by short-term problems in the financial markets. We have used the 4% rate. The STPR discount rate is also the minimum rate of return required by the Dept. of Finance. Financial appraisal rates are higher, but they include an allowance for inflation.

8. Test Model Results - calibration

Our result shows a BCR of 0.86 and an IRR of 2.48% with a net loss of €550 million. This is significantly below the near breakeven BCR of 1.03 and IRR of 4.3% claimed.

We have not yet made any assumption about residual value. The residual value is the capital value attributed to the infrastructure at the end of the analysis period, in this case 2047. We do not know what assumption the RPA made. If the full original €2.8 billion is assumed as the value in real terms in 2047 (an option proposed by the CAF), the BCR improves to 1.01 and the IRR to 4.1%, which is still a bit low.

We find, if we increase the 2010 growth rate from our initial 0% to 2.37%, we get a good fit to the RPA's results: BCR 1.03 and IRR 4.3%. Other variables could be tweaked to produce the RPA's result; the capital renewal rate assumption being an obvious candidate, but we will assume these values. This effectively calibrates our model with that of the RPA for the No Growth scenario. This allows us to carry out some sensitivity tests on a number of variables. We will refer to this calibrated Test

Model result as the Base Test in that it mirrors the RPA's Base Case (No Growth) scenario.

9. Sensitivity tests

We have reproduced the RPA's No Growth result in our Test Model by deducing the assumptions they may have made. Some of these assumptions should be questioned. Adjusting these assumptions will tend to depress results. We can explore the extent to which they depress results using our calibrated model.

The assumptions we would question are: the rates of real growth assumed; the application of real growth rates to benefits only and not to (post-construction) annual running costs, including capital renewal costs; the non application of the required 50% penalty for use of public funds and the lack of testing of a possible construction cost overrun.

9.1 Sensitivity – real growth rates.

The real growth rates assumed in our Base Test are those proposed by CAF guidelines (with the exception of 2010, which we adjusted to get a best fit with the RPA's result). The near term economic outlook is not as good as the CAF figures, which date from June 2009, suggest. According to the Department of Finance, the appropriate index is growth in real wages. With the degree of adjustment needed in the next few years to improve our competitiveness, we can rather expect contraction rather than growth, in real terms. We also question the assumption that we can continue to rely on steady significant real growth into the future, given issues such as climate change, peak oil and loss of competitiveness to emerging economies. We propose to test the results with zero growth in 2010 and 2% per annum from 2011 onward.

The result is a BCR of 0.96, an IRR of 3.67% and a net loss of €160 million. This shows results are not highly sensitive to *small* changes in real growth assumptions over a long period. Nevertheless, the application of real growth assumptions is crucial for the result reported. For example, if we assume they do not apply to benefits, the BCR falls to 0.7, the IRR to 1% and we get a loss of €1.2 billion. Therefore the case for this crucial adjustment needs to be examined as well as the rates of growth assumed.

For comparability with the DBC, we will apply the real growth factors and use the Base Test assumptions for real growth rates.

9.2 Sensitivity – residual value

We have assumed the DBC assumed the residual value of the infrastructure in 2047 was the same in real terms as its initial construction cost of €2.8 billion. It is also quite critical for results. If it is dropped, the Base Test result drops to a BCR of 0.88,

and an IRR of 2.7%, with a loss of €470 million. It is therefore another assumption that needs to be confirmed.

9.3 Sensitivity - economic growth and costs.

If the value of time saved is considered to grow in line with economic growth as indicated by GNP per person employed, or real wage growth as recommended by the NDP/CSF unit of the Department of Finance, it should also apply to ongoing annual costs, which will be heavily influenced by unit labour costs. Further, energy costs are likely to follow, if not exceed, future economic growth. Restoring Base Test growth assumptions, we applied the same annual economic growth factors to operating costs and capital replacement costs, as were applied to the value of time. The results produced a BCR of 0.81, an IRR of 1.7% with a net loss of €980 million. This assumption has quite a negative impact on results as it counters the assumed real growth in unit benefits.

9.4 Sensitivity - penalty for use of public funds (shadow price of public funds).

The Department of Finance requirement for a penalty of 50% for the use of public funds seems to have been ignored in the DBC. The 50% penalty was originally recommended by Prof Patrick Honahan, et al, in 1999.[18]

> "Shadow Price of Public Funds: In order to take account of the distortionary effects of taxation, a shadow price of public funds of 150% should be applied to Exchequer cash flows (taxes, grants and subsidies) to make them commensurate with private cash flows."

A footnote further notes:

> "While additional public expenditure can be financed through additional borrowing in the short-run, this will ultimately give rise to a tax burden on future generations. Accordingly, all public expenditure can be looked upon as being funded from taxation."

The rate was dropped to 25% some years ago (when we had large surpluses). When the Department of Finance looked at the Revised Business Case figures for the Metro North they insisted that, inter alia, the penalty of 25% be applied. The penalty has recently been restored to 50%, according to the CSF/NDP Unit.[19]

> "On a related point, it is important that a shadow cost of public funds of 150 percent should be applied to exchequer sourced funds in CBAs of capital investment proposals in the public sector, so as to account for the distortionary effects of taxation."

This surcharge should apply to all capital outlays, which are eventually paid either directly by the Exchequer or as annual PPP payments. As the fuel payment and any

operating cost top-up over fare revenue also come from public funds, they should also carry the penalty of 50%.

When we apply this penalty the BCR falls to 0.78, the IRR to 2.1% and a net loss of €1.17 billion. When combined with the test for real growth in running costs, we get a BCR of 0.63, an IRR of -0.5% and a loss of €2.42 billion. We see that with the required penalty applied to public funds the proposal falls well below the minimum return requirement.

9.5 Sensitivity – cost overrun.

As we pointed out in our Oral Hearing submission, Prof. Bent Flyvbjerg found that, on average for 44 urban rail projects, cost overruns were 45% and ridership was overestimated by 50%.[20] He recommends the use of "reference class forecasting", under which experience with similar projects elsewhere is factored into the analysis. This means that sensitivity testing should be carried out assuming such possible overruns. It could be argued that the ridership sensitivity test has been applied by using the No Growth scenario. However it appears that no sensitivity test was done on the possibility of a cost overrun.

It will be argued by the RPA that the PPP arrangement protects the Exchequer from the risks of overrun in construction costs. Even though the Exchequer will bear something under 50% of the construction costs (DBC 6.6.6), with over 50% to be borne initially by the contractors, all of the construction risk including cost overruns will be borne by the contractor (DBC 6.6.5). However, while the PPP contracts shift the risk from the Exchequer to the contractors, the costs of any overrun are still borne by society as a whole and must be fully charged to the project. CBA takes a society-wide approach and not simply an Exchequer view of costs and benefits.

Further, it has been pointed out that tender prices have been falling, indicating that better value for money is to be had. This is probably correct but it is not correct to assume that lower tender prices always reflect real costs. For CBA the costs must be the "real" social cost and not a below cost bid. Bruce Shaw points out that while tender prices have fallen, actual costs have not fallen by much, which indicates below cost tendering is taking place, with risks of company failure.[21] Tom Parlon, Director General of the Construction Industry Federation, confirmed this on 12 November 2010.[22] Even if the PPP arrangement appears to shift much of the risk from the Exchequer to contractors, if the contractors fail because they have over-squeezed their margins, the state will be left with the costs of recovery.

To be consistent with Prof. Flyvbjerg's advice, a sensitivity test adding 45% to construction costs should have been carried out. When we do this test relative to the DBC's Base Case, the BCR drops to 0.83, the IRR to 2.6% with a net loss of €860 million.

9.6 Combined tests

When the three tests are combined: real growth in running costs, penalty for public funds and cost overrun, we get a BCR of 0.52 an IRR - 1.7% and a net loss of €3.9 billion.

10. Fare revenue double counting

The DBC analysis may have double counted fare revenues. Table 7.3 (from which figures are blanked) sets out the economic appraisal results. It has separate entries for user time savings and revenue, which are added into total benefits. If, as it seems, revenue and therefore fare revenue, is included in addition to user benefits, this is double counting. The main benefit to society is the user time saved. The user makes a contribution (transfer) equal to the fare to the operator but that is not (before considering the effect of the shadow price of public funds) an additional net benefit to society, it is already included in the total benefit to the user. Another way to look at it is that the net user benefit has dropped by the fare paid. The Exchequer gains the fare but the user loses it. This double counting leads to a huge exaggeration of benefits. We estimate, in 2009 terms, the time saved benefit is €7 per passenger and the fare is €2.2, therefore benefits have been exaggerated by over 30%. If benefits are cut back accordingly, it is clear the overall results will be much worse than reported. The model used is a hybrid cost benefit analysis (societal point of view) and financial analysis (Exchequer point of view). This sort of confusion is common in such hybrid models.

Considering the paper by Prof Patrick Honohan, [23] it could be argued that, when applying the penalty for public funds, there should be an offset for the fare revenue generated because it reduces the amount of taxes needing to be raised, at the margin. This would mean deducting a proportion of the fare revenue equal to the penalty rate, from the costs of the project, which have already been augmented by the penalty applied to public funds used. If the rate is 50% then costs that are met by public funding should be increased by 50%, while a deduction of 50% of fare revenue (and other revenue from the project) could be made. This is far from adding all the revenue as a benefit on top of the user time saved benefits. And of course the argument only applies if the penalty is also applied to public funds consumed, which the RPA appears to have ignored.

When we test for this by adding 50% of the fare revenue as a benefit, we find that the BCR becomes 0.85 and the IRR 2.7%. This compares to the test in 9.4 above for the 50% penalty on public funds (with no penalty offset from fare revenue) where the BCR was 0.78 and the IRR was 2.1%. As expected, allowing for the shadow price of public funds for both additional taxes and additional revenue, moderates some of the deterioration due to the penalty on extra tax alone, but clearly does not compensate for it.

If the DBC added revenue as a benefit on top of user benefits derived from time saved, how has our Test Model reproduced the DBC's No Growth scenario results so closely? It may be just a coincidence, but the RPA probably assumed renewal costs were already included in their operating cost assumption. Fare revenue per annum at €55 million (2.2*25.1m) just about offsets the renewal costs we assumed at 2% of

€2.8 billion, or €56 million. We do not know what figures the RPA used but they could have been of this order.

11. Tabulation of Results

The following Table 1 sets out the basic assumptions made and conclusions arrived at by the RPA in its hybrid CBA/financial PPP model of Metro North compared to our simple CBA model. With very limited and heavily redacted information we have, as far as possible, made the same assumptions as the RPA, while sticking more closely than the RPA to standard CBA methodology (for example by accounting for capital when consumed rather than when paid for, and ignoring inflation by assuming real values).

Table 1: RPA's No Growth scenario compared with our Test CBA Model.

Model	RPA	Test Model
Result: BCR	1.03	1.03
Result: IRR	4.3%	4.3%
Construction Period	2012-2016; 5 years.	2012-2016; 5 years.
Operation Period	2017-2047 (30 years).	2017-2047 (30 years).
Base year	2002 (unusual choice) but proposed by CAF.	2009
Discount rate (real)	4%	4%
Passengers per annum.	25.1 million	25.1 million
Capital cost of construction	€2.5 bn - €3 bn. Mixture of initial Exchequer funding and PPP payments and over 25 years from 2017.	€2.8 bn. All charged during construction phase 2012-2016 in equal annual tranches of €560 million.
Capital replacement (renewal).	Maintenance and renewal costs included in estimated PPP payments. No details.	Renewal cost of €56 million p.a. (2% of €2.8 bn) assumed. Not included in unit operating costs.
Average journey length.	Not stated	About 13 km, say 15 km.
Average time saved per passenger	Unstated but between 11 and 25 minutes	20 minutes estimated as most trips involve Swords and Dublin City.
Value per hour of time saved. 2009	We assume CAF parameters used: €22 business - €9 non-business (2002).	Used CAF parameters to get an estimate of €21 (75% business) for 2009.
Economic growth	Probably CAF rates, including 2.29% from 2017 on. Probably applied only to value of time.	CAF rates from 2011 and 2.37% for 2010, to get match with DBC result. Applied only to value of time, for Base Test.
Operating cost (per passenger). 2009	€2.2 fare plus some (undefined) energy cost and unspecified top-up.	€3.50 (Paris €3.2 – London €4) = fare of €2.2, energy cost of €0.30 and assumes top-up of €1.00 per passenger.
Real growth in	Probably none assumed.	Real growth rates in value of time

costs.		also applied to costs. BCR: 0.81, IRR 1.7%
NDP/CSF Shadow Price of Public Funds of 150%; or penalty of 50% on taxes used.	Not mentioned. Assumed to have been ignored.	Not assumed in Base Test. When tested, results are much worse, BCR: 0.78; IRR: 2.1%. When shadow price also applied to fare revenue, BCR: 0.89; IRR: 2.8%.
Construction overrun.	Not mentioned as risk passed to Infrastructure Contractor.	Risk is still borne by society. Test of 45% overrun gives BCR of 0.83 and IRR of 2.6%.
Combined sensitivity tests:	Not done	Real growth in unit costs, public funds penalty 50%, cost overrun 45%, BCR: 0.52, IRR –1.7%

12. Wider Impacts

We have said little about the DBC's "Wider Impacts" analysis, which reportedly brings the Moderate Growth scenario to a BCR of 2. We are not convinced by such claims. They also apply to alternatives, including the "do nothing" alternative of leaving the money in the pockets of taxpayers to spend as they see fit and generate other "Wider Impacts". Recall that the Department of Finance insists on a penalty of 50% for the use of public funds because of the distortions involved. This would be an odd policy if the claimed "Wider Impacts" were real and positive. We believe that the penalty of 50% should be properly applied to public spending on Metro North and that wider benefits should be ignored because they do not help distinguish between alternatives, including the "do nothing", non-distorting alternative.

13. Implications, transparency

With sensitivity testing, our model results are much more pessimistic than those of the RPA and therefore we must question the robustness and reliability of the RPA's model which seems to produce a result that might be sought by an advocate for the proposal. This is not an independent analysis. The OBC and RBC were done by Steer Davies Gleave. There is no attribution other than the RPA for the DBC. Therefore we do not know who did this analysis. The RPA claims its analysis has been independently verified.[24] The DBC does not mention this so we do not know who was involved. Of course, we are given no further information and are required to accept this in good faith.

When we see that the No Growth option, which was reported to have a BCR of 1.03 and an IRR of 4.3%, and to meet the Department of Finance minimum rate of return of 4%, only has a BCR of 0.51 and an IRR of – 1.7% when subjected to our three sensitivity tests simultaneously, it is impossible to accept the claims for the Moderate Growth (BCR of 1.55) and the other scenarios. There could be arguments about the extent of the cost overrun to be tested for. There can be little case for ignoring the

real growth in unit running costs if real growth in the value of time is to be allowed to inflate benefits. There is no case for ignoring the Department of Finance requirement for a 50% penalty to be applied to public spending. It follows that the RPA's claims for a breakeven No Growth scenario, and a high return Moderate Growth scenario do not stand up. We cannot test the Moderate Growth scenario, as the patronage data only seems to exist for one year 2025 or maybe 2026 (36.3 million). The combined sensitivity tests of the No Growth scenario halved the results from a claimed breakeven. It is certainly possible the Moderate Growth scenario would not survive such tests either.

It must be repeated that even if it did, it remains to be shown to be the best option. To establish this, other options have got to be subjected to the same rigorous testing. It is not sufficient to dismiss options such as the BRT with the casual remark that it will take up road space. Department of Finance Guidelines require *all* alternatives to be rigorously analysed. Realistic options are to be identified and the costs and benefits of *each* option over the life cycle of the project must be determined. The analysis cannot be confined to the "preferred option". [25]

A Final Business Case analysis is to be carried out when the preferred bidder is selected and before a Government decision. We would expect that this analysis will conform properly to appraisal guidelines by examining real alternatives to the current proposal and take account of weaknesses identified above, such as the failure to apply a shadow price of public funds.

A major problem is the lack of transparency and lack of independent analysis. On the nonsensical excuse that competitive bidders will commit commercial suicide by increasing their bids if they see details of the analysis, the taxpayer is being abused by a system of administration that holds the citizen in contempt. The public and their representatives are left with a highly selective analysis, which emphasises only the case for the favoured project. Scrutiny is not allowed but the taxpayer may be committed to massive expenditure on misleading grounds because of a lack of transparency. This lack of good governance is a clear example of the "disconnect" or lack of accountability by Government for state agencies that was identified by the OECD in its 2008 report "Towards and Integrated Public Service." That "disconnect" has been a major contributing factor to our current economic crisis.

The limited release of information may be worse than no release, as it allows promoters to propagate and exploit results favourable to their cause, but critics have little or no chance to challenge those claims. The only rationale for this selective release of positive results is propaganda. The blatant example here is the claim that the central assumption scenario has a BCR of 1.55 or even 2.0 ("two Euros for one"), which does not stand up to our scrutiny. The project is probably not even breakeven, and even if it is, it is probably not the best option. This is not an acceptable standard of governance of our public affairs. Only independent evaluation of investment proposals and full disclosure can resolve the issue.

Finally we note that we have to operate with the limited information made available. Apart from the redacted material many of the details of the DBC analysis are very obscure. It is possible there is an explanation for our failure to confirm the claimed results, in which case we are open to enlightenment. If there are flaws in our

reasoning and deductions, our defence is that the RPA's obfuscation of information is the primary problem. Why do taxpayers have to play hide-and seek with the authorities to find out what is being done with their money and who the real beneficiaries are? Have we not had quite enough of that game?

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15 November 2010.

Acronyms used

RPA	Railway Procurement Agency
OBC	Dublin Metro Project Outline Business Case for Metro North
RBC	Dublin Metro Project Revised Proposal (Business Case)
DBC	Metro North Updated Detailed Business Case
CBA	Cost Benefit Analysis
NDP	National Development Plan
CSF	Community Support Framework
BCR	Benefit to Cost Ratio
IRR	Internal Rate of Return
DCC	Dublin City Centre
BRT	Bus Rapid Transit
DCU	Dublin City University
CAF	The Common Appraisal Framework (Department of Transport)
GDP/GNP	Gross Domestic/National Product
PPP	Public Private Partnership
STPR	Social Time Preference Rate

Endnotes

[1] It is available in searchable form here: http://www.nationaltransport.ie/MNDBC_final.pdf

[2] Steer Davies Gleave for RPA, Dublin Metro Project, Outline Business Case, undated. See: http://www.transport21.ie/Publications/upload/File/FOI/Dublin_Metro_Project_Outline_Business_Case.pdf

[3] Steer Davies Gleave for RPA, Dublin Metro Project Revised proposal, RPA, undated. See: http://www.transport21.ie/Publications/upload/File/FOI/Dublin_Metro_Project_Revised_Proposal_June_2003.pdf

[4] The Base Case is defined as the Moderate Growth scenario: "The Moderate Growth land use scenario is believed to be the most realistic forecast and has been used as the basis for the Base Case." However, the usage is not consistent. E.g. in 4.5 we have: "In the Base Case LA Growth scenario, an AM peak load of 6,700 passengers is forecast...."

[5] Page 22 of the RBC says: "Work has continued on the RPA's model since November [2002] and the revised model reflects stronger than expected demand in the forecast year (2016) for public transport and a more congested transport network in the do minimum situation. This means that relative time saving benefits have increased at a greater rate than the patronage. "

[6] http://www.ien.ie/sustainable-transport/metro-north-key-questions/

[7] See www.aris.ie for further details on BRT options for Dublin.

[8] In paragraph 3.8 of his evidence to the Metro North Oral Hearing Mr Rory O'Connor of the RPA said:

> "A bus alternative was not assessed as a bus corridor cannot provide the capacity needed or the journey time to attract large amounts of car users to public transport to meet the objectives in terms of modal shift. The maximum capacity of a bus corridor is around 2,000 passengers per hour per direction."

This was stated in spite of the fact that BRT systems are known to move 30,000-plus passengers per hour, each direction. In short, Rory O'Connor made the serious error of stating that max bus capacity was only 2,000 per hour per direction.

[9] Using figures provided by Mr David King to the Oral Hearing and the revised figures in the DBC we can conclude that at opening there will be between 18.5 and 21 million per annum. This also produces a mid-range estimate of about €20 million.

[10] Fearghal O'Connor, Business and Finance; "Metro: End of the line?", November 2010, http://www.businessandfinance.ie/bf/2010/11/interviewsandfeaturesnovember2010/metroendoftheline

[11] In NPV (2009) terms this is only €2.2 billion rather than a nominal €2.8 billion.

[12] See Appendix 1 of Guidelines on a Common Appraisal Framework for Transport Projects and Programmes June, 2009: http://www.transport.ie/upload/general/11801-DOT_COMMON_APPRAISAL_FRAMEWORK1-0.PDF

[13] We have taken a conservative consumption of 0.5 MJ per passenger-kilometre. This source suggests 0.78 MJ for Light Rail. http://richardgilbert.ca/Files/2007/Grid-connected%20vehicles%20%28Energy%20Policy%29.pdf

[14] http://www.icai.org/resource_file/97241012-1018.pdf

[15] http://www.hm-treasury.gov.uk/d/green_book_complete.pdf

[16] http://www.finance.gov.ie/documents/publications/other/CApraisspotcheckguidance.pdf

[17] http://www.finance.gov.ie/viewdoc.asp?DocID=5387
[18] See: Proposed Working Rules for Cost Benefit Analysis, CSF Evaluation Unit, June 1999
http://www.ndp.ie/documents/publications/evaluation/Workingrules-cost-benefit-analyis.doc

[19] See: Infrastructure Investment Priorities 2010-2016: A Financial Framework. July 2010 at
http://www.finance.gov.ie/documents/publications/reports/2010/capitalreview.pdf

[20] Flybjerg, Bent, Cost Overruns and Demand Shortfalls in Urban Rail and Other Infrastructure, Transportation Planning and Technology, February 2007
http://flyvbjerg.plan.aau.dk/Publications2007/URBANRAIL61PRINT.pdf

[21]
http://www.bruceshaw.ie/cost_management/latest_publications/Bruce%20Shaw%20Handbook%202010.pdf

[22] On News at One, RTE Radio 1, 12 November 2010:

Sean O'Rourke: But is it possible that some companies, and I don't know if that would apply in McNamara's case, have been tendering so competitively that they are not leaving enough margin for themselves to ensure they can see through the project?

Tom Parlon: I think that's an absolute fact. There's been an unsustainable level of tendering lately. It's been cut to the bone. Competition is intense, and clearly people attempting to stay viable and maybe trying to buy some work, and buy some cash flow, you know, and that is, you know currently, I believe attitudes are changing now. The people know that that is unsustainable, and unfortunately we see, which is a tragedy today for a long-term company like McNamara's or like Pierce just a couple of weeks ago, gone into liquidation, so that has been the case certainly, the scarcity of work.....

[23] Key Issues of Cost Benefit Methodology for Irish Industrial Policy, See:
http://homepage.eircom.net/~phonohan/costbenefit.pdf

[24] See: http://www.rpa.ie/en/news/Pages/MetroNorthMythsandFacts.aspx

[25] See: http://www.finance.gov.ie/documents/publications/other/capappguide05.pdf

For example, the guidelines repeatedly demand that alternatives or options be rigorously and impartially analysed and compared. On page 33 the 2005 guidelines state:

> "Objectives should be expressed in a way which will facilitate consideration and analysis of alternative ways of achieving them. *They should not be so expressed as to point to only one solution*."