BIM Level 2 Benefits Measurement - Summary Guide

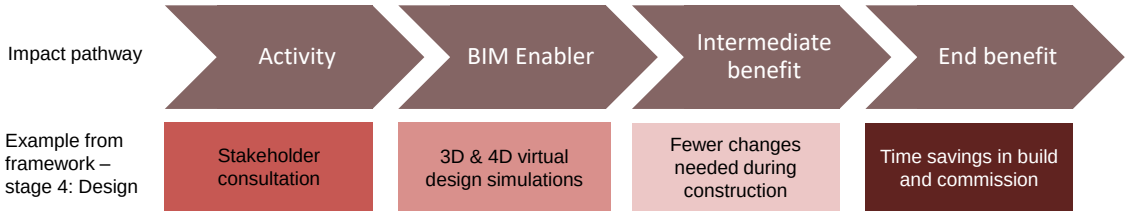
The purpose of the BIM Level 2 **Benefits Measurement Methodology (BMM)** is to assist government construction clients and asset owners to assess and measure the benefits from application of BIM Level 2 on capital projects and assets in operation. In this 3-page guide we provide a brief overview of the contents of the BMM (including its two parts: (1) the 'Introductory Note'; and (2) the detailed BMM). We describe how to use these two documents to identify and quantify benefits from the use of BIM Level 2.

Part 1 – Introductory note: Approach and benefits framework

This document describes the approach taken to develop the BMM *(Chapter 3);* it contains the benefits framework by which project-level benefits may be realised *(Chapter 4)*; and explains the economic principles underpinning benefits measurement *(Chapter 5)*.

The **benefits framework** *(Chapter 4)* describes the principal ways in which 'project level' benefits are expected to arise from the application of BIM Level 2. The framework is organised by the eight stages of the asset lifecycle (from 'strategy' to 'operation and end of life').[1] Application of BIM Level 2 in early stages of the asset lifecycle can often lead to benefits being realised in later stages. The benefits framework accounts for this, capturing all identified impacts, regardless of timing differences.

The framework contains 117 unique 'impact pathways'. These describe the impacts from application of different elements of BIM Level 2 at each lifecycle stage. Each pathway culminates in an 'end benefit' that may be estimated using the measurement methodology developed.

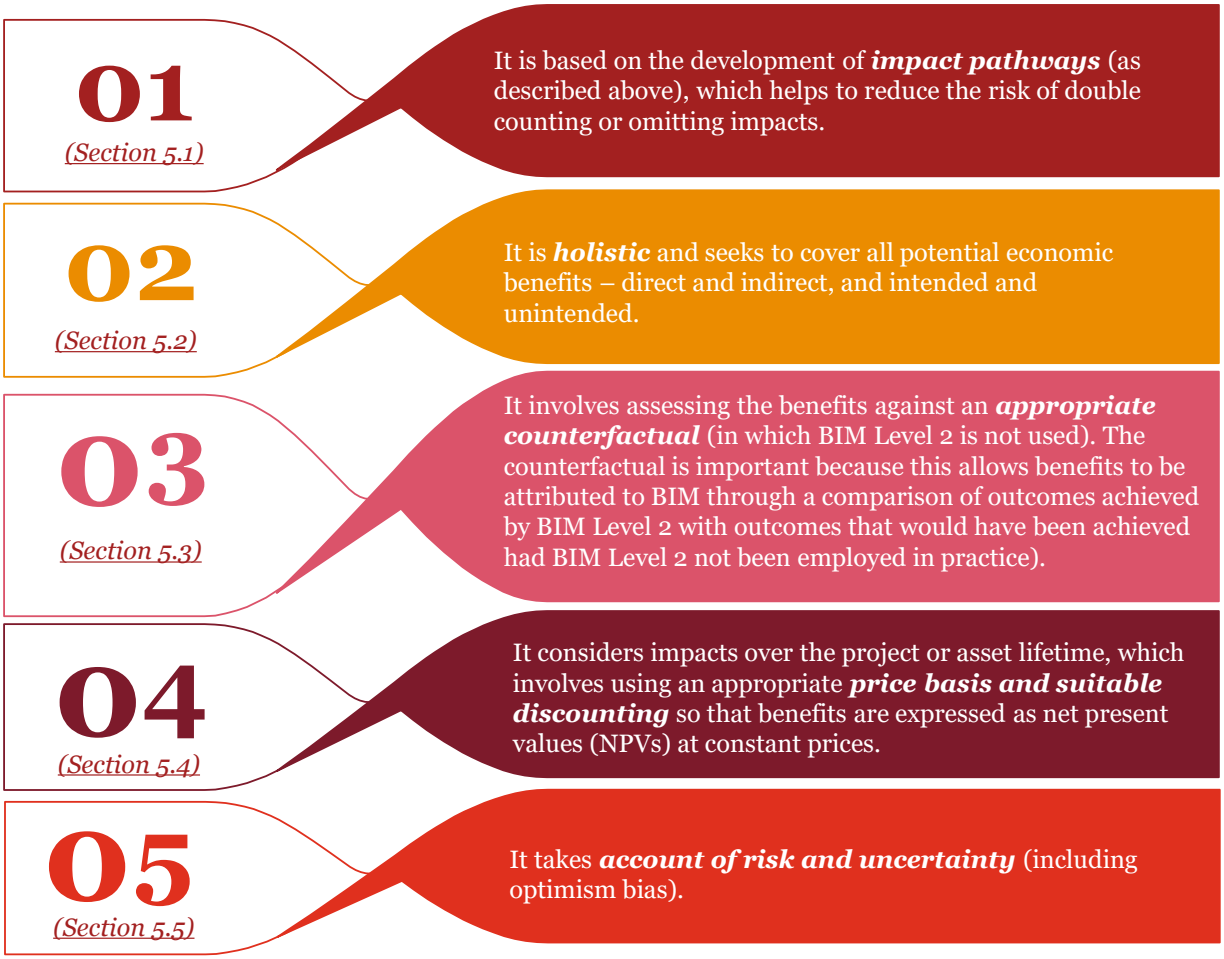


The framework can be used to identify the benefits that may be achieved from application of BIM Level 2 on a particular project, at each stage of the asset lifecycle. In effect, it provides a long list, or 'menu' of possible benefits, and their corresponding BIM benefit drivers *('BIM Enablers')*.

The **economic principles underpinning the BMM** *(Chapter 5)* are the basis for our measurement approach. Our BMM has been developed to be consistent with the Infrastructure and Projects Authority (IPA) guidance on benefits realisation;[2] and the HM Treasury Green Book,[3] which provides guidance on how to appraise and evaluate the costs and benefits of projects.

[1] Asset lifecycle stages are defined in PAS1192-2:2013.
[2] Infrastructure and Projects Authority, 'Guidance for Departments and review teams. Assurance of Benefits Realisation in Major Projects. Supplementary Guidance v1, April 2016, available at: https://www.gov.uk/government/publications/major-projects-authority-assurance-toolkit
[3] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/685903/The_Green_Book.pdf

The five key principles that underpin the measurement methodology are:



The document concludes by outlining some practical considerations, and a list of factors to consider before attempting measurement *(Chapter 6)*. These include the potential size of a benefit, the type of asset being assessed, who the benefit is likely to accrue to, and the ease of measurement.

Part 2 – BIM Level 2: Benefits Measurement Methodology

This document provides a detailed methodology for measuring the potential benefits of applying BIM Level 2 across the asset lifecycle during asset delivery, asset operation and in business operation / service delivery. It describes the process for quantifying and monetising the benefits identified in the *benefits framework*.

The BMM groups the benefits into eight measurement categories, explained across its eight chapters (see summary of the eight categories on the next page). The eight measurement categories each contain a number of the 117 impact pathways from the *benefits framework* (described above). The categories are defined based on similarities in the measurement process, and are independent of the stage of the asset lifecycle at which the benefits are realised.

The BMM provides guidance on how to quantify and monetise each category of benefit; and how to identify the supporting data required. It also illustrates the measurement methodology by applying it to case studies.

1 Time savings

(Chapter 1; Sections 1.1-1.6)

Nature of the benefit: The use of BIM has the potential to result in time savings in a number of different ways, both in asset delivery throughout each stage of the asset lifecycle, and in service delivery (or business as usual) for a government organisation. For example, use of a Common Data Environment (CDE) enables easier ways of working and quicker information exchange.

Measuring the benefit: Time savings resulting from BIM Level 2 can be monetised by calculating the corresponding reduction in (1) *direct labour cost*; or (2) *time-dependent recurring preliminary costs* (in the case of an overall reduction in the duration of a project). If time savings result in accelerated project delivery (and project benefits are brought forward in time), the net present value (NPV) of the project may also increase.

2 Materials savings

(Chapter 2; Sections 2.1-2.2)

Nature of the benefit: Use of BIM Level 2 has the potential to result in materials savings in the 'build and commission' and 'operation and end of life' (maintenance, refurbishment, etc.) stages of the asset lifecycle, by reducing the volume of materials required (including reducing wasted materials).

Measuring the benefit: Materials savings are estimated by calculating the change in the amount or type of materials used, and applying the cost of each type of material to the reduction in quantity. There may also be corresponding environmental benefits from using fewer materials. These are estimated by applying the 'embodied carbon value' as a proxy for the total environmental impact to the reduction in the material's quantity (in line with Green Book guidance).

3 Cost savings

(Chapter 3; Sections 3.1-3.7)

Nature of the benefit: Application of BIM Level 2 has the potential to result in other, broader cost savings across the asset lifecycle where it is difficult to distinguish the component time and materials elements. The benefits framework includes for example, cost savings from fewer changes, better clash detection, and improvements in facilities management and maintenance.

Measuring the benefit: Cost savings may be estimated in a number of ways, depending on the specific saving in question. In general, savings can be quantified by determining the change in the number of instances of a particular event attributable to BIM Level 2 (e.g. the number of changes); and monetised by applying the average cost of each instance (e.g. average cost of undertaking a change).

4 H&S Improvement

(Chapter 4; Sections 4.1-4.2)

Nature of the benefit: The use of BIM Level 2 can contribute to health and safety improvements, throughout both the 'build and commission' and 'operation and end of life' stages of the asset lifecycle. For example, a 3D model provides the visual basis for improved staff briefing and training, with further potential provided through 4D-type simulations, (including construction and demolition activities), to optimise sequencing from a safety perspective.

Measuring the benefit: Benefits from improved health and safety are quantified by determining the difference in the number of fatal and non-fatal injuries and work related illnesses attributable to BIM Level 2; and monetised by applying the cost to society per accident, incident or work related illness (using values published by the Health and Safety Executive (HSE)).

5 Risk reduction

(Chapter 5; Sections 5.1-5.2)

Nature of the benefit: The use of BIM Level 2 has the potential to improve the accuracy of information about a project or asset, and improve visibility about associated costs, delivery timeline, and risks. Because of this increased certainty provided by BIM Level 2, there is a potential for a reduction in the variability of costs and time required for asset delivery and operation. This may result in the ability to reduce the contingency required against capital expenditure and/or operating expenditure, thus resulting in a reduction in costs associated with that contingency.

Measuring the benefit: Benefits from reduced risk are quantified by determining the reduction in contingency attributable to BIM Level 2; and monetised by applying the opportunity cost of capital to the change in value of the contingency. *(UK Government opportunity cost of capital = social rate of time preference = 3.5% pa – Green Book).*

6 Improved asset utilisation

(Chapter 6)

Nature of the benefit: The use of BIM Level 2 can improve the availability of an asset once it has been constructed: this means that it can potentially be used more productively over its lifetime to provide public services. Better space utilisation planning; faster maintenance and refurbishment through use of an asset information model; and faster BIM enabled response to incidents; can all improve asset availability, or reduce an asset's downtime.

Measuring the benefit: Benefits of improved asset utilisation are quantified by determining the increase in productivity (%) or reduction in downtime attributable to BIM Level 2; and monetised by applying the relevant value for that productivity increase (either the avoided cost of downtime [*e.g. cost to rent an alternative classroom while regular classroom is unavailable*], or the social benefit that would be lost through downtime [e.g. *cost to society of students foregoing education while classroom is unavailable – more difficult to measure*]).

7 Improved asset quality

(Chapter 7)

Nature of the benefit: Use of BIM Level 2 brings improved visibility over the process of design and construction, which can enable improved quality of the asset for the end-user. For example, BIM's 3D and 4D visualisation capabilities may result in a building being better laid out, or more pleasant to be in (the building may be angled to get more sunlight for example).

Measuring the benefit: The impact of improved quality depends on the asset, what it is used for, and how improved quality can directly affect user outcomes. Examples of direct quality effects that may be quantified are reduction in staff turnover as a consequence of improved staff morale or satisfaction with the working environment; or reduction in the length of hospital stays due to improved building amenity contributing to quicker recovery times.

8 Improved reputation

(Chapter 8)

Nature of the benefit: The application of BIM Level 2 could potentially improve the reputation of government construction clients and asset owners, and the supply chains involved in asset delivery; by improving the experience of those associated with asset delivery and service delivery. For example, in asset delivery, use of BIM Level 2 may result in better site layout and improved logistics. This could reduce (or avoid) negative impacts on residents, businesses and customers who reside near the construction site.

Measuring the benefit: Improved reputation is difficult to quantify, and often intangible. It may be possible to quantify through use of surveys, however difficulty arises in attributing reputational improvements to BIM Level 2 because many factors contribute to reputation, and it is difficult to isolate the extent to which each is responsible.