TRANSPORT

Visualisation Requirements Guide

IP Integrated Management System

Document number:	**DMS-SD-130**
Version:	**1.1**
Document owner:	**Director Digital Twin Integration**
Published date:	**December 2022**
Next review date:	**December 2023**

NSW GOVERNMENT

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1 General

1.1 Context and purpose

The guide has been developed to interface with the Transport for NSW (TfNSW) Digital Engineering (DE) Framework, but can also be used for projects that do not use the DE Framework.

Creating a range of different visualisation types will help in the identification of what visualisation will be needed for a project. The visualisation types will be driven by the software application and will propose what the visualisation is intended to be used for and the audience it is aimed at.

Certain visualisation types will also benefit from a standardised material pallet to help expedite the interpretation of the visualisation.

Understanding how the visualisation will be presented and the appropriate medium in which it will be used will drive the output.

Some of the benefits of generating standard types of visualisations are:

- Better stakeholder engagement and understanding of proposal designs.
- Faster production of visualisation by using native modelling software applications where possible.
- Improved stakeholder and community engagement experience through a range of visualisations.
- Stakeholders will be presented with a consistent view of proposed TfNSW projects.

The purpose of this guide is to establish a common approach to develop requirements that define how visualisations should be delivered for a project. These requirements are then used to procure services to deliver visualisations that support the planning, design, and delivery of TfNSW projects.

1.2 Scope and application

This guide is applicable to Infrastructure and Place (IP).

This guide describes the elements to procure the appropriate visualisation outcomes during the Plan and Acquire phases of the asset life cycle. The core elements covered in the guide include:

- **Visualisation requirements**, which cover defining the type of visualisation that is appropriate for the intended purpose, potential workflows, scope of the visualisation, usage of 3D models and existing information.

- **Management requirements**, include defining how the visualisation shall be delivered and shall be detailed in the Digital Engineering Execution Plan (DEXP).
- **Technical requirements**, which provide information on technical standards the visualisation may need to comply with, for example visualisation accuracy and level of detail, and validation.
- **Deliverable requirements**, which provide guidance on the expected visualisation outcomes and project deliverables.

Project teams are expected to modify or supplement the information provided in this document to meet project specific needs. Note that this document does not provide any information on whether visualisation should be applied to a project or not. The use of visualisation by a project should be determined during development of the project strategy (refer to 5TP-ST-168 – *Project Delivery Strategy Standard*).

This guide does not cover:

- All the use cases for visualisation such as wayfinding, people flow simulation or Health and Safety in Design.

Transport is currently developing a roadmap for Augmented Reality and Virtual Reality (AR/VR) as well as supporting documentation for other visualisation products in the form of templates for minor works briefs. This guide will be updated to refer to this documentation as it becomes available.

1.3 Terms and definitions

The terms and abbreviations used in this document have the meaning/definitions provided in DMS-SD-123 – *DE Terms and Definitions*.

The following terms and definitions are specific to this guide:

Term	Definition
Visualisation contractor	An organisation outside of Transport for NSW offering and delivering visualisation services.

1.4 Reference documents

The following documents and online resources are referenced in the text:

- **5TP-ST-168 – Project Delivery Strategy Standard**
- **DMS-PR-031 – IP Procurement Procedures**
- **DMS-ST-202 – Digital Engineering Standard Part 1 – Concepts and Principles**
- **DMS-ST-207 – Digital Engineering Standard Part 2 – Requirements**

- **Digital Engineering Scheme – SCM7971** (on NSW Government eTendering website)
- **IP Commercial Management Framework**
- **IP Digital Engineering Framework** (public website)
- **Transport Agency Style Guide**
- **Transport Internal Brand Templates**
- **Transport External Brand Templates**
- **NSW Government Brand Guidelines**
- **Photomontage policy** from the **Land and Environment Court of NSW Policies webpage** (accessed on 28 November 2022)
- **Transport Agency Style Guide**
- **Transport Brand Hub SharePoint site**

2 Process

Visualisations are conducted at various stages of a project to help communicate proposed design intent. Some visualisation types will need to be specifically procured, however some types of visualisation are able to be quickly generated from certain BIM authoring tools and can provided the level of communication required without extended amounts of effort. In order to be able to create quick visualisations from the BIM authoring tools, the DE models need to be set up consistently in terms of element materiality.

One of the many benefits the DE Framework enables is the use of the same information for many different purposes. In terms of visualisation, when a BIM model has been created it is possible for this to be reused in the visualisation creation process. This means that quick visualisation can be generated from the BIM authoring tools themselves, or, depending on the visualisation type required, the BIM models can be used in an extended visualisation workflow and reused in specialised 3D visualisation software.

This guide is linked to the following frameworks, standards, processes and procedures:

- The IP Digital Engineering (DE) Framework, including DMS-ST-202 – *DE Standard Part 1 – Concepts and Principles* and DMS-ST-207 – *DE Standard Part 2 – Requirements*.
- The IP Commercial Management Framework, including DMS-PR-031 – *IP Procurement Procedures*.

Refer to the Digital Engineering Scheme – SCM7971 for prequalified suppliers that have substantial expertise in visualisation including

- Production of high-quality model rendering and rendered animations to support project/asset visualisation and stakeholder engagement; and
- Provision of AR/VR solutions to support project delivery, asset management outcomes, and for stakeholder engagement.

3 Visualisation requirements

3.1 Overview

Visualisation encompasses the application of a broad range of technologies to create an output to be used for any type of communication. Some visualisation types will need to be procured specifically, while other visualisations will be able to be produced as a part of the design process using certain BIM authoring tools and can be achieved with little additional effort.

The typical process to be followed by TfNSW and the visualisation contractor is outlined in Figure 1.

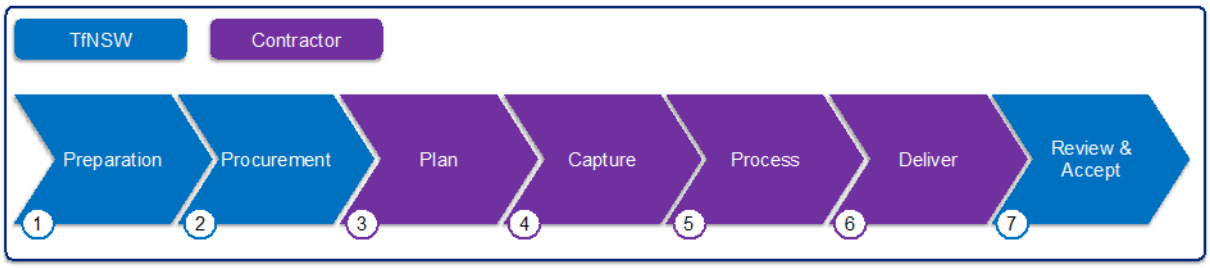

Figure 1 – Phases of a typical project

This includes the following key activities:

1. **Preparation**, which involves TfNSW identifying the visualisation requirements using the information provided in this document.
2. **Procurement**, which involves development of the scope of the visualisation requirements for the project.
3. **Plan**, which is predominantly a contractor activity that involves the TfNSW project team agreeing the key contractor activities required to undertake the visualisation work. This activity will provide the inputs required for the contractor to develop the visualisation section in the project DEXP.
4. **Capture**, for certain visualisation types, contextual video or photography may need to be captured. Specific materials and model content may also need to be

sourced. This focuses on the visualisation contractor collecting the base visualisation data within the timeframes approved by TfNSW.

5. **Process**, which is the period of the engagement when the visualisation contractor will be undertaking the visualisation activities. This will include applying materials and lighting to the 3D environment to create a rendering of the design. This will either be using BIM models created as part of the project process or creating a 3D model specifically for visualisation from other design information provided. Additional site contextual information such as people, trees, vehicles and other relevant artefacts may be added. Post-production activities on renders will also likely be undertaken in a post-production software to enhance the visual undertaken as part of the photomontage process.
6. **Deliver**, which involves the handover of the deliverables, and should include the visualisation contractor demonstrating (explaining) the deliverables provided. Deliverables will generally include the intended visualisation output and the raw visualisation data used the generate the final visualisation output.
7. **Review and accept**, which involves the TfNSW project team reviewing and accepting the visualisation deliverables and that the deliverable can be used for the purpose intended.

This document provides a standardised set of visualisation requirements to assist TfNSW projects to procure appropriate visualisation outcomes, including:

- Scope requirements (Section 3.2)
- Management requirements (Section 3.3)
- Technical requirements (Section 3.4)
- Deliverable requirements. (Section 3.5).

Note that the guidance provided in this document is not an exhaustive set of requirements and shall be tailored to meet project specific requirements.

A standard library for objects and materials is currently under development. This will help in the production and standardisation of both the BIM model environment and materiality and visual presentation of objects. For more information on this please contact the TfNSW DE Team. See Section 5 for feedback and help contact details.

The project requirements for visualisation are generally incorporated into a services brief based on the standard TfNSW Infrastructure and Place services contracts.

3.2 Scope requirements

3.2.1 Introduction

Scope requirements define two main elements in relation to visualisation:

- The larger overall TfNSW program or project that the visualisation requirements relates to and which the outcomes shall support.
- The scope of the actual visualisation itself, including the type of visualisation, the visualisation area, whether a BIM model is to be utilised, any existing information that may be needed or incorporated for the visualisation, and the timeframes.

The following sections provide a description of the types of information that a project team should include when defining its scope requirements in the services brief.

3.2.2 Project overview

Provide a general overview of the project, highlighting specific information on:

- The objectives of the program/project.
- High level overview of the project scope, including an outline of the geographical area impacted by the project.
- Whether the project is adopting the TfNSW DE Framework for project delivery. If the project is a DE Framework project, there are various considerations to be included, including information on concepts, principles and requirements (for example, collaboration, sharing of data, preferred data and file formats, and so on) as outlined in DMS-ST-202 – *DE Standard – Part 1* and DMS-ST-207 – *DE Standard – Part 2.*
- The project phase the visualisation relates to, including what the visualisation will be used for as part of the overall project.

The majority of this information should be available from the project's project management plan.

3.2.3 Visualisation objectives

Define the objectives of the visualisation, including the planned and potential uses of the deliverables.

Uses of the visualisation and the outcomes are to be described to help both TfNSW and contractors understand which type of visualisation, data formats, and medium will be most appropriate.

Potential uses may impact on the following requirements and assist contractors to identify key aspects in their proposals.

To define visualisation objectives it may be useful to answer the following questions:

- Who will use the visualisation deliverable, that is, who are the project stakeholders?
- How will the various project stakeholders use the visualisation?
- What sort of visualisation is required to support informed decisions on the project?
- What level of realism is required to support appropriate use of the data to support decision-making?
- How will people view the visualisation and where, if appropriate will the visualisation be hosted for viewing (for example, external facing website, mobile 360 viewers, published documentation)?
- When should the visualisation be completed?
- What relevant base data does the project team already have access to, including internal and external to TfNSW? The base data may be used as an input to the visualisation process.
- How will the data be received, stored and managed by the project team/TfNSW?

3.2.4 Types of visualisations

Define the type of visualisation required for the project, which may include a combination of the types of example visualisations outlined below to achieve the desired outcomes. The examples below are not meant to be an exhaustive list of all the different types of visualisations. The type of visualisation undertaken may depend on the project stage.

- **Proposal communication** – this type of visualisation is intended to clearly communicate the proposed changes to existing infrastructure. This form of visualisation can be used to clearly illustrate to stakeholders the modifications or additions that will take place. Examples include adding lifts to a station, installing a footbridge over a motorway, and so on. This type of visualisation can often be created straight from the BIM authoring software. The following should be considered:
    - **Materials** – existing elements in the design can be coloured a consistent flat grey colour, as shown in Figure 2. A suggested RGB value for the light grey could be Red 190, Green 190, Blue 190. This is a suggested RGB as the visualisation and lighting used within the rendering package can

alter the shade of this grey. An appropriate shade is to be agreed and used consistently across all existing, unmodified objects. New or modified elements are to have the appropriate material applied to them as per their specification. If the exact material is not known, then an appropriate colour should be applied to clearly differentiate it from the existing model geometry.

- **Lighting** – conditions reflective of the geographical location, project orientation and specification of lighting elements incorporated in the design should be imitated. In doing so will achieve an accurate representation of the lighting and shadowing that can be expected. The exact date and time of day for the visualisation should be considered and communicated.
- **Context** – unless appropriate this type of visualisation does not need the model to be located visually within the project environment.

Figure 2 – Example image showing proposal communication type visualisation

Photorealistic artistic impression – this type of visualisation is a photorealistic artistic impression of the proposed design. This type of visualisation incorporates the proposed to scale design, materials and real world lighting as accurately as possible. An example is shown in Figure 3. Depending on the BIM authoring software being used, it is possible that the visualisations could be produced straight out of the software. However, in some cases, additional software will need to be used in an extended workflow to create the final visualisation. The following should be considered:

- **Materials** – depending on the project stage some materials may not be known. It is important to ensure where possible, materials specified in the design documentation are accurately represented on the model objects.
- **Lighting** – conditions reflective of the geographical location, project orientation and specification of lighting elements incorporated in the design should be imitated as accurately as possible.
- **Context** – where possible site contextual information, should be incorporated into the visualisation. In this type of visualisation, the proposed design is not meant to be accurately positioned to show integration with existing contextual site and location information.

Figure 3– Example image showing photorealistic artistic impression type visualisation

- **Photorealistic photomontage** – Figure 4 is a photorealistic visualisation of the proposed design in the context of its surrounding environment. This type of visualisation incorporates the proposed to scale design, materials and real world lighting conditions based on site location. Depending on the BIM authoring software being used, it is possible that the visualisations could be produced straight out of the software. However, in some cases, additional software will need to be used in an extended workflow to create the final visualisation. The following should be considered:
  - **Materials** – it is important to ensure the materials specified in the design documentation are accurately represented by the textures used and applied to objects in the software creating the visualisation.

- **Lighting** – conditions reflective of the geographical location, project orientation and specification of lighting elements incorporated in the design should be imitated. In doing so will achieve an accurate representation of the lighting and shadowing that can be expected. The exact date and time of day for the visualisation should be considered and communicated.
- **Context** – photography or video of the proposed site and location can be captured and incorporated in the visualisation process to allow for the compositing of the proposed design into the surrounding environment, an example is provided in Figure 4. The proposed design is to be accurately scaled and positioned to show integration with existing contextual site and location information.

Figure 4 – Example image showing photorealistic photomontage type visualisation

- **Augmented reality/virtual reality (AR/VR)** – Computer-generated simulation of a three-dimensional image or environment that can be interacted with a seemingly real or physical way by a person using special electronic equipment, such as a helmet with a screen inside or gloves fitted with sensors. AR/VR can offer better and more immersive ways to engage on our plans, projects. Work is underway at Transport to develop a cluster wide roadmap for augmented reality, this section will be updated as the work on the roadmap progresses.

3.2.5 Visualisation workflow examples

3.2.5.1 Introduction

Depending on the visualisation type selected there is likely to be different workflows undertaken to produce the final output. Due to the creative nature of visualisation there can also be variants to the example workflows described below. This can be for many reasons, including the software and specialist plug-ins being used or the output required. Also whether there is a BIM model that can be utilised due to the stage of the project can affect any of the example workflows below.

3.2.5.2 Direct workflow example

The workflow in Figure 5 is an example of how a visualisation could be created directly from the BIM authoring software. This example also covers the scenario where there is no BIM model and the 3D modelling and visualisation is created solely in specialist visualisation software. In this case only steps 2 and 3 are relevant.

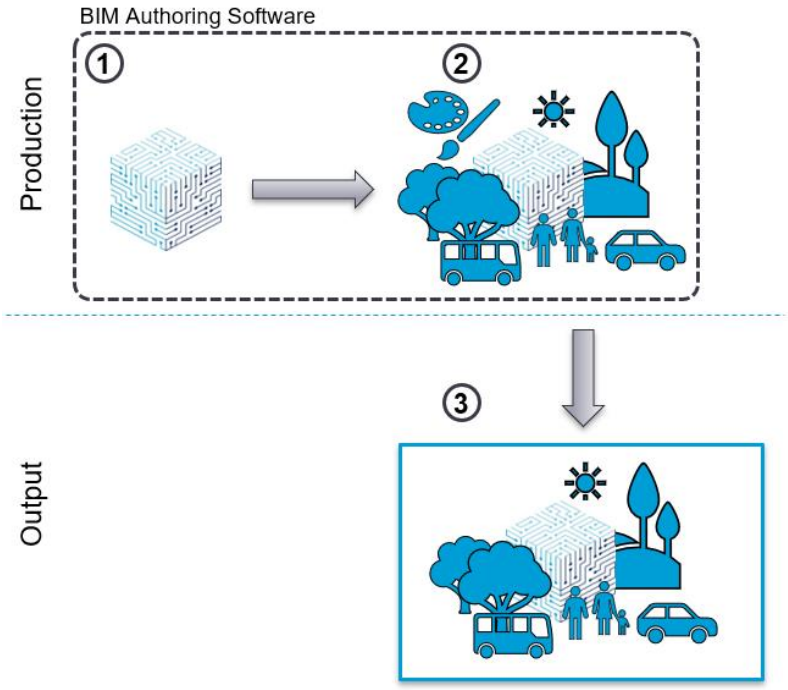

Figure 5 – Direct workflow example

The direct workflow steps are as follows:

1. The BIM model can be used as a base for the development of visualisations.
2. The BIM model can be further embellished with lighting, materials and contextual artefacts such as landscaping, people and vehicles. Some BIM authoring software will allow for a basic level of visualisation enhancement and

rendering. There are visualisation plug-ins for BIM authoring software that allow for more realistic rendering outputs to be achieved without having to export the BIM model into specialist visualisation packages.

3. Once the further enhancements have been made it is possible to create an output from the BIM authoring tool for viewing. These outputs could be the rendered images, animations or 360° panoramic images as described in the deliverable medium section.

3.2.5.3 Extended workflow example:

The workflow in Figure 6 is an example of how a visualisation could be created using specialist visualisation and post-production software.

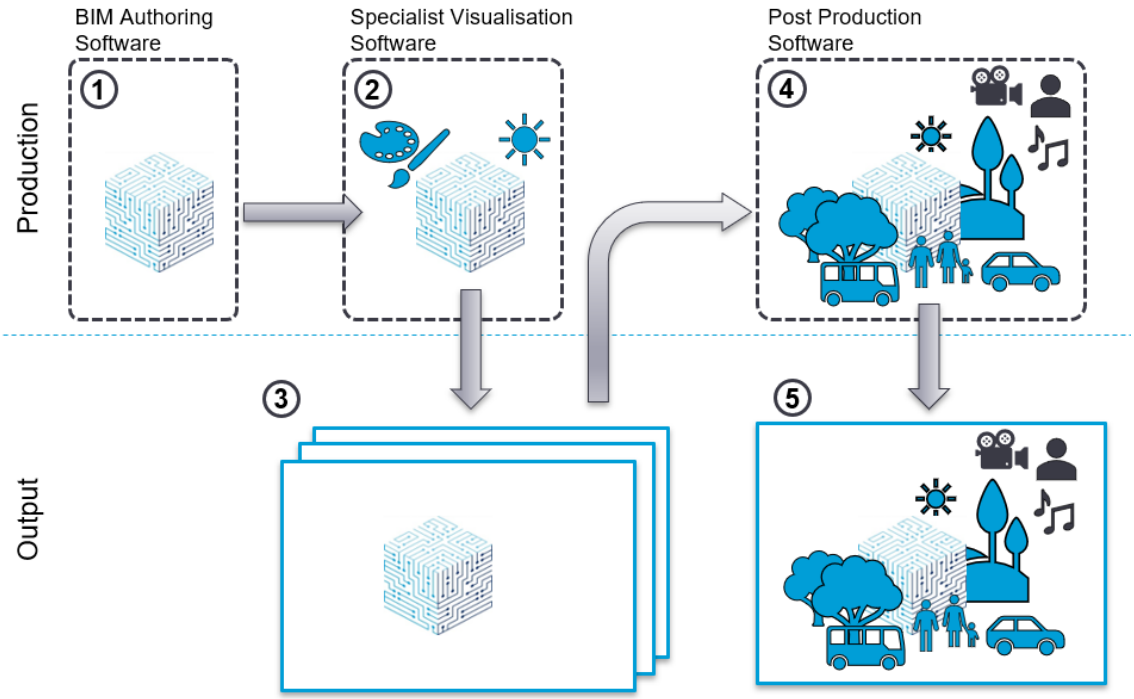

Figure 6 – Extended workflow example

The extended workflow stages are as follows:

1. The BIM model can be exported out using the appropriate model exchange format into Stage 2, the specialist visualisation software.
2. The BIM model can be further embellished with lighting and materials. It is also possible at this stage to add further contextual artefacts such as landscaping, people and vehicles. However, for the purposes of this example the additional artefacts such as landscaping, people and vehicles are incorporated into the process at Stage 4.

3. The appropriate output is created from the specialist visualisation software. This could be a still image or a series of images that are later stitched together to create an animation in Stage 4.
4. The individual image or series of images to create an animation are imported into post-production editing software. In this example workflow contextual artefacts such as landscaping, people and vehicles are added. It is often common for multiple renders, created from the visualisation software to be composited in this post-production software. These renders could be used to help control lighting, transparency, reflectivity and shadowing of the final output in Stage 5. This is done as it allows the visualisation specialist greater control over the realism of the final output.

   Should music, voiceovers or live video be a part of the intended video output, it is at this stage where these inputs are incorporated into the overall animation.
5. Once the further enhancements have been made it is possible to create an output from the post-production software for viewing. These outputs could be the rendered images or video animations as described in the deliverable medium section.

3.2.6 Deliverable medium

There are a range of options available to select as the end visualisation medium. This can range from images and animations that can be incorporated into project websites for marketing media through to 360° panoramic imagery for viewing on both traditional website pages or mobile devices. The medium type will need to be understood as this will affect the specification of the end deliverable.

There could be a range of different medium types required as part of the one project and these need to be specified individually. Understanding what the media will be used for and where they will be used is important. Consider the different channels the imagery will be used in – will the image only be needed for a website or within a Word document? Or will the image need to be displayed on a large billboard or poster?

Example medium types are detailed below, including some of the considerations you will need to discuss and identify to form part of the visualisation requirement.

- **Digital imagery**:
  - **File format** – what file format or type is needed? There are many different file types ranging from JPG, TIFF, PNG and EPS, and so on. Do you require vector or raster image files:
    - ◊ **Raster** images comprise of pixels to form the image. Common raster file types include JPG and TIFF. Most photos found online or in print

are raster images. They have a defined proportion based on their resolution. If you scale an image to be a size they weren't originally intended to be they become distorted and blurry, leading to low quality.

It is likely that JPG file format will be appropriate for imagery that will be used when creating content for the web. This file type can also be used for printing if a high resolution is specified.

TIFF files are a lossless raster format that are perfect for high quality printing, especially at a large dimension. Because of this they are very large in size. They can be used but aren't recommended for web browsers.

◊ **Vector** has greater flexibility and are constructed using proportional formulas. Common vector file formats include EPS, AI and SVG. Even though they may have greater flexibility they may not be appropriate for the presentation use. Vector files are often used as the type of format when creating company logos.

- **Image resolution** – pixel dimension relates to effectively how much 'space' the image needs to occupy. Think of this as the height and width dimensions of the image. DPI or PPI relates to the pixel density and needs to be considered with the purpose of the image in mind. Websites generally display images at 72 dpi, which is a low resolution however, the images will look very crisp when displayed online. Also consider what might be required for viewing the image on mobile devices. Printing often required a higher resolution. Often 300 dpi as a minimum is a suggested guide. The resolution will also affect the file size of the image, a higher resolution will result in a larger file size.

- **360° panoramic imagery**:
  - **File format** – it is likely the format required for panoramic imagery will be Raster. How you wish to host and share the panoramic image may influence the file type required.
  - **Image resolution** – as mentioned under Image resolution for digital imagery, this requirement may be influenced by where this type of imagery is hosted, any specific software that is used for viewing and the hardware/device used to view it on. If these items are understood then the appropriate image resolutions can be specified.
- **Animations and video files**:
  - **File format/video container** – what type is needed? There are many different file types ranging from AVI, MOV, WMV, MP4, and so on. How

the video will be opened or viewed will influence this. As an example, will the file be hosted on a website or just be opened from a local drive?

A flexible file format to use is MP4. Even after compressing the file to reduce its size they still have high quality. They are often used for sharing over the web or can be viewed by users on their desktops, able to be viewed by various media players and editing software. It can also contain metadata and offers more compatibility than other formats. It can be viewed on Apple and Microsoft devices, such as computers, tablets, phones and even TV. It is also a format that can be inserted into Microsoft PowerPoint.

- **Codecs** – codes are used to compress and decompress a video file. Without compression video files can be very large in size. The type of Codec used will depend on how the video will be distributed, such as streamed from a website or burned to disk or viewed from a local computer drive. The type of codec used will depend on the file format/video container specified.
- **Frames per second/frame rate** – the number of frames per second (or frame rate) for the animation also needs to be considered. When an animation is played, the frames per second specifies how many frames/images are viewed in a second of animation. The higher the frames per second, the smoother the viewing experience of the animation. The example resolutions below will all have their own standard frame rate to achieve the visual playback quality needed for their intended broadcasting. With a higher frame rate, more rendering and processing will be needed to create the frames/images. This will have an impact on the overall rendering time the visualisation software takes to render the frames for the animation.
- **Video resolution** – the video resolution required will depend on where the video will be played. This impacts the effective pixel dimension required to be produced. TfNSW Corporate Communications has three standard resolutions that can be used with their standard template in After Effect video editing software:
  - ◊ 1000 x 1000
  - ◊ 1080 x 1920
  - ◊ 1920 x 1080 (1080p) (HD) (Blu-ray players, HDTV) high definition, Blu-ray quality.

- **AR/VR**;
  - How is the AR/VR solution to be hosted? How will it be archived when the contract is complete and how will it be handed over to Transport? Can

the delivered data be leveraged for a future project phase or future contract?

- Work is underway at Transport to develop a cluster wide roadmap for augmented reality, this section will be updated as the work on the roadmap progresses

3.2.7 Visualisation scope

The visualisation scope sets out the extent of the visualisation required for the project, including the following details, as appropriate:

- The number of still perspectives required and if appropriate the location and direction of the view for the camera. This can be applicable to both photorealistic artistic impressions and for photography or video captured that will be used in creating photorealistic photomontage visualisations.
- The target area, infrastructure, facilities and services to be visualised, including:
  - Description of the visualisation area with reference to detailed maps and diagram(s).
  - Identification of zones of interest within the project area that may require specific focus for visualisation. This could be certain view angles and perspectives or a specified path showing passenger journey through a space.
- Any specific areas or assets that are excluded from the visualisation.
- Assumptions and limitations for the visualisation, including identifying inaccessible areas that may impact on the ability of the visualisation contractor to undertake photography or video capture.
- Security constraints, including security issues related to the physical sites that are being visualised.

3.2.8 3D model availability

If BIM models are to be used as a part of the visualisation aspects of the project, it is critical to define this expectation. The 3D model being created as a part of the design process is able to be used to help create the visualisation. Depending on the visualisation software being used, the BIM model could be imported into the software and used as a basis to further develop the visualisation. This makes use of the existing available information and saves time remodelling.

The project stage will dictate the level of geometry detail available and already modelled by the project team. This is known as the Level of Detail (LoD) as defined in DMS-ST-207 – *DE Standard – Part 2*. Even though the elements in the model may

be at the correct LoD for the project stage, this may not be enough detail needed to create a photo realistic visualisation. If this is the case, it is important to ensure that model elements or artefacts used and created specifically in the visualisation are as specified in other project documentation and are appropriate for the project stage. TfNSW owns any additional objects and content that have been used and developed for the creation of the visualisation. These additional content items shall be provided alongside the deliverables.

The BIM models may also contain artefacts that can help in the visualisation process. Where specified lighting fixtures have IES files available, the files can be used as inputs to accurately simulate the lighting. Material textures that have been applied to the elements in the model may also be used to visually represent the material properties. These are all items that can help in the visualisation process. However, they are not always handed over or included within the BIM file itself. So, consideration needs to be given to make sure these files are included should they be needed. An example of 3D model information to be provided to TfNSW is provided in Table 1.

Table 1 – Example of 3D model information to be provided to TfNSW

Information	Format	Source	Comments
3D model	Native file format, IFC, FBX, Obj., and so on.	Project team	-
Material pallet	Various, potentially JPG, TIFF, and so on.	Project team	-
Lighting fixtures photometric files (lighting data for light simulation)	IES, and so on.	Project team	-

3.2.9 Existing information

Define the contents and source (internal or external) of any existing information to be provided to the contractor to support the visualisation, as outlined in Table 2.

Table 2 – Example of existing information to be provided

Information	Format	Source	Comments
Survey – digital	DWG, Photogrammetric models, Point Cloud	Project team	
3D model	Native file format, IFC, FBX, Obj., and so on.	Project team	
3D model	Native file format, IFC, FBX, Obj., and so on.	Project team	

3.2.10 Visualisation timeframe

Clearly define the expected start and end milestone delivery dates for the project. The expected timeframes are usually driven by the project that the visualisation relates to. Even though the visualisation process has become a more integrated process due to the technology available, the outcomes required impact on the level of detail, render processing and post-production required. The rendering and post-production processing is typically where the majority of effort is expended for both photorealistic artistic impression and photorealistic photomontages (see Figure 7) and must be considered when specifying visualisation timeframes.

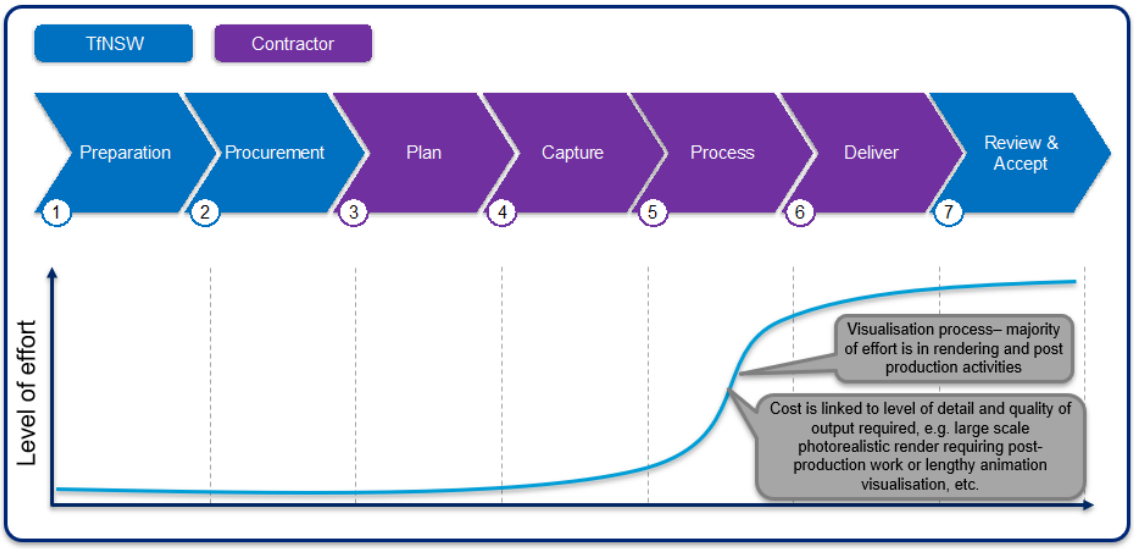

Figure 7 – Level of effort

If available, key milestone dates should be defined for:

- Expected project start date.
- Data, photography or video capture dates and constraints, that is, identify specific windows of opportunity to conduct site surveys, for example time restrictions within the rail corridor.
- Visualisation deliverables due date. When determining the due date, keep in mind that the majority of the effort is in processing of the visualisation. This can be to render a high quality still or series of images from the rendering application that will then need to be stitched together in the post-production software.

3.3 Management requirements

3.3.1 General

Management requirements typically define how the visualisation contractor is to work with TfNSW with the aim to understand the contractor's proposed approach, governance arrangements, general project management and specific data management activities.

This detail can be provided within the Visualisation section of the DEXP. The Visualisation section can also be used to provide technical details on how the visualisation will be produced and delivered to meet TfNSW's requirement.

3.3.2 Collaboration

Visualisation contractors are to provide an appropriately experienced team, which will work collaboratively with TfNSW, other contractors and key stakeholders.

Collaboration can be established through different mechanisms, and should be discussed and agreed at a pre-planning visualisation meeting. This meeting should be held immediately after contract award.

The different ways of ensuring collaboration throughout the engagement include:

- Holding a pre-planning meeting to confirm the visualisation requirements, clearly identifying lines of communication for all stakeholders, and identifying all milestone deliverables. Additional items to be discussed and agreed at the meeting include the visualisation objectives, security or access constraints, mobilisation strategy (to be confirmed in the DEXP).
- The delivery and review of sample visualisations at the earliest opportunity, including making available mechanisms for stakeholders to access the visualisation (for example, online access to rendered imagery, 360 panoramic images, animations, and so on).
- Holding regular progress meetings and providing communications on progress throughout the life of the project.
- Holding a post-delivery review to ensure that the TfNSW requirements have been met.

It is critical for TfNSW to continue to expand the corporate knowledge of the Transport network, including identifying and accessing visualisation data collected by individual projects. Ensuring TfNSW receives re-useable data and information from visualisations is a key enabler for this to be realised.

3.4 Technical requirements

3.4.1 Introduction

The technical requirements identify the requirements related to:

- Visualisation contractor's capability (see Section 3.4.2)
- Acts, regulations and standards (see Section 3.4.3)
- Visualisation accuracy (see Section 3.4.4)
- Validation (see Section 3.4.5).

The items in this section provide a baseline for technical requirements for inclusion in the services brief, however depending on specific project requirements additional technical items should be added where required.

3.4.2 Contractor visualisation capability

The standard TfNSW capability requirements specify that contractors are to provide skilled and capable personnel to perform the works required. However, for visualisation work it is important that the visualisation contractor provides appropriately skilled visualisers to direct and be responsible for all visualisation work.

Requesting the following information will assist TfNSW project teams to assess suitability of visualisation contractors:

- Experience and qualifications of key personnel including previous work examples relevant to the type of visualisation being procured.
- Management systems to support visualisation projects.
- Visualisation software to be utilised, including information on how they intend to process the rendered images either using in-house or offshore rendering facilities.
- Collaboration and data sharing practices to be employed on the visualisation project (for example, information exchange standards, including working using a Common Data Environment or CDE).

3.4.3 Acts, regulations and standards

3.4.3.1 General

When undertaking certain types of visualisations, there may be requirements based on the sensitivities of the project to ensure that the visualisation conforms to a minimum standard.

For example, the Land and Environment Court of NSW has a policy that specifically relates to the production of photomontages. For more information refer to the Land and Environment Court website. **The following shaded text is an excerpt** from the policy that relates to photomontages that can be relied on as or as part of expert evidence in Class 1 appeals.

"Requirements for photomontages:

1. Any photomontage proposed to be relied on in an expert report or as demonstrating an expert opinion as an accurate depiction of some intended future change to the present physical position concerning an identified location is to be accompanied by:

Existing Photograph.

a. A photograph showing the current, unchanged view of the location depicted in the photomontage from the same viewing point as that of the photomontage (the existing photograph);

b. A copy of the existing photograph with the wire frame lines depicted so as to demonstrate the data from which the photomontage has been constructed. The wire frame overlay represents the existing surveyed elements which correspond with the same elements in the existing photograph; and

c. A 2D plan showing the location of the camera and target point that corresponds to the same location the existing photograph was taken.

Survey data.

d. Confirmation that accurate 2D/3D survey data has been used to prepare the Photomontages. This is to include confirmation that survey data was used:

i. for depiction of existing buildings or existing elements as shown in the wire frame; and

ii. to establish an accurate camera location and RL of the camera.

4. Any expert statement or other document demonstrating an expert opinion that proposes to rely on a photomontage is to include details of:

a. The name and qualifications of the surveyor who prepared the survey information from which the underlying data for the wire frame from which the photomontage was derived was obtained; and

b. The camera type and field of view of the lens used for the purpose of the photograph in (1)(a) from which the photomontage has been derived."

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Copyright notice and disclaimer webpage. See Section 1.4 for link to source material.)

3.4.3.2 TfNSW communications standards

All customer-facing visualisation deliverables and materials should comply with Transport for NSW's brand and style guidelines such as the *Transport Agency Style Guide*, the Templates for External Communications, and the Templates for Internal Communications. For links to guides, see Section 1.4. For support contacts see Section 5.

3.4.4 Visualisation accuracy

Visualisation results should be an accurate representation that meet the specific requirements of the project. In defining accuracy requirements for the visualisation deliverables the visualisation contractor, in conjunction with the project delivery team, is able to assess whether they are able to provide visualisation to the accuracy required.

A number of factors affect the accuracy of visualisation and the output generated:

- Correctly modelled and detailed model objects.
- Accurate material representations applied to the elements in the model that are also appropriately scaled.
- Surface properties of materials applied to elements, including reflectivity, opacity and surface bump maps, and so on.
- External lighting using geographically precise lighting information and artificial lighting using lighting specifiers lighting parameters.
- Camera lens and field of vision used to create the rendered output.

3.4.5 Validation

To validate the accuracy of the visualisation, it is suggested that confirmation of adherence to and incorporation of the items highlighted in Section 3.4.4 Visualisation accuracy is provided.

Should accurate photomontages be required the additional information outlined in Section 3.4.3 Acts, regulations and standards should be provided.

3.5 Deliverable requirements

3.5.1 Introduction

The deliverable can be made up of two parts. This is split into the required visualisation deliverable, the content or files that have been used in the process of

creating the visualisation and, if appropriate, a visualisation report or expert statement.

- Visualisation deliverables, which includes the direct visualisation deliverables to be provided by the visualisation contractor and in most cases will be a combination of the items as outlined in Section 3.5.2 Visualisation deliverables.
- Visualisation report or expert statement, this document may be required for certain types of visualisation that require verification as to its accuracy. This may be required for sensitive development sites where scale, positioning and lighting are of critical importance for planning or stakeholder purposes. This project documentation is to be provided to TfNSW by the visualisation contractor in support of the visualisation deliverables as described in Section 3.4.3 Acts, regulations and standards. This document is only required if specifically requested by TfNSW.

3.5.2 Visualisation deliverables

The type and format of final deliverables required for a project shall be defined.

File naming conventions of all deliverables should follow the ECM file naming conventions agreed for the project, as required and outlined in DMS-ST-207 – *DE Standard – Part 2*.

Table 3 suggests deliverables that should be considered for the three visualisation types defined in Section 3.2.4.

Potential deliverables can differ for the different visualisation types. Once the visualisation process is understood, a better understanding of the deliverables required can be requested.

Table 3 – Visualisation deliverables

Deliverable	Description
Deliverable output file	This will be the selected deliverable medium for the scope of work. This could be multiple types depending on what has been selected. As an example this could be a 360° panoramic image or digital image. These files should be listed in the *Master Information Delivery Plan (MIDP)* (DMS-FT-555).

Deliverable	Description
BIM authoring, visualisation and post-production software package files	The BIM authoring file is a standard delivery requirement under the DE Framework. It is important to receive the additional software files that are created as part of an extended visualisation workflow. These additional files can be created by the specialist visualisation software package or the post-production software package used. TfNSW require the native files to be provided as well as open file formats that can be used for exchange of information between the various visualisation software. Due to the variety of different visualisation software packages and the industries they have initially been developed to service, there are a range of options for open file formats. Understanding what the authoring software is will help in defining the appropriate open file format that should also be provided. These files should be listed in the *Master Information Delivery Plan (MIDP)* (DMS-FT-555).
Material maps	When real life material images are applied to the elements in the model based on design specifications, it is important to make sure these image files are issued to TfNSW. Many of the BIM authoring and visualisation software packages reference material maps locally. So unless the material maps are also provided as separate files (JPG, TIFF, and so on) then materials will not display properly should the file be opened at a later date as material maps will be missing.
Supporting workflow content	In extended visualisation workflows, there is a range of content that can be created, which form part of the final deliverable. This can be the imagery rendered out of the visualisation software that can then be edited an enhanced in the post-production software. It is important that this information is delivered so that it can be referenced by post-production software at a later date.
Artefacts	Depending on the visualisation type being delivered and its specific workflow, the 3D scene is often embellished with additional artefacts such as landscaping, people and vehicles. This can be done within the BIM authoring, visualisation or post-production software applications using specialist plugins or purchased content. It is important to capture the additional artefacts where possible however, there may be separate licencing issues around the use of these outside of the visualisation contractor. Understanding how this part of the work is done will help understand what information may be handed over as part of the deliverable.

4 Document history

Version	Published date	Summary of changes
1.0	31 October 2019	First issue
1.1	December 2022	Included references to AR/VR and to future AR/VR roadmap. Included reference to SCM7971 prequalification scheme.

5 Feedback and help

For general enquiries and assistance with the application of this guide and associated DE standards, guidelines, education, training, or planning and commencing a digital visualisation enabled project, please contact the DE Team at **Digital.Engineering@transport.nsw.gov.au**.

The DE Team will liaise with the relevant domain experts where necessary to provide the relevant support.

For support with using the *Transport Agency Style Guide* or other brand enquiries, refer to the Brand Hub SharePoint site or contact the Brand team at **brand@transport.nsw.gov.au**.

The DE Framework embraces a culture of continuous improvement. Suggestions, comments and feedback are welcomed and encouraged.