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Health risk (e.g. injury and death)

Managerial risk (e.g. productivity and quality)

Environmental risk (e.g. weather)

Economic risk (e.g. cost of labour plant and materials)

Legal risk (e.g. contracts, clauses and regulations)

Fire risk (e.g. hot works and burning of site waste)

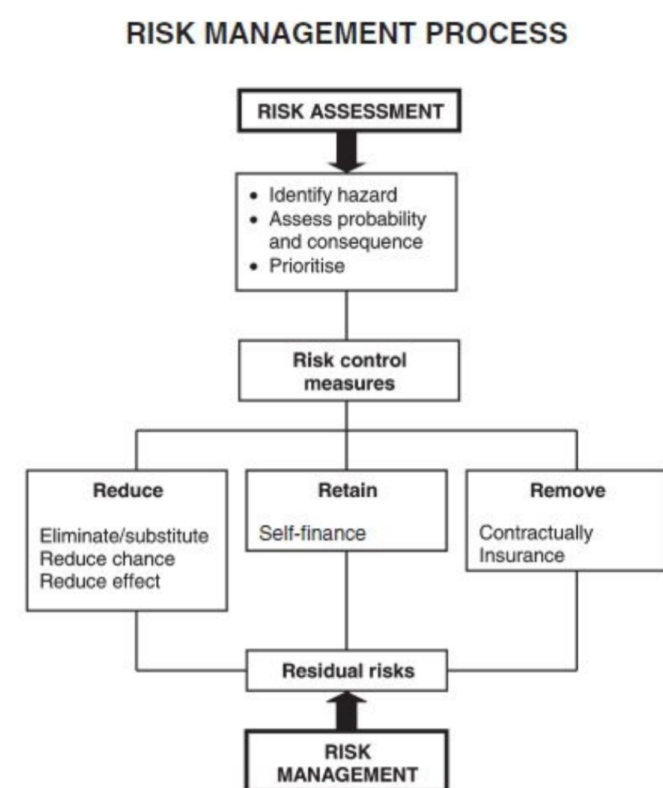
Financial risk (e.g. cash-flow)

Technical risk (e.g. design failures)

These risks will be allocated to parties and contractually bound within a standardised contract such as **NCT** or **JCT**. The purpose of this is to prevent the pre-occurrence of these events occurring, and moreover, ensuring that provisions have been made for their occurrence.



Identifying hazards is an essential part of risk management. Approaches often vary contractor to contractor, modelling their approach to the process illustrated in *Figure 1*.



Risk Management

The identification of project risks are recorded in a **risk register** (Figure 2); where the CIOB Code of Practice for Project Management defines this as a **“formal record for risk identification, assessment and control”** (CIOB, 2019).

[illegible]

Figure 2: Generic risk register (Cooke 2013).

Traditionally, under the JCT suite of contracts the biggest risks are undertaken by the principle contractor, however, following the *Latham Report (1994)* this adversarial approach was criticised, citing the more collaborative NEC contract as an enhanced way of working.



Within the formulation of an NEC contract there is scope for the **reallocation of risk**, this gives the parties a element of **cost control** where principally, the more risk allocated to a party equates to an higher entitlement of cost (*see Figure 3*).

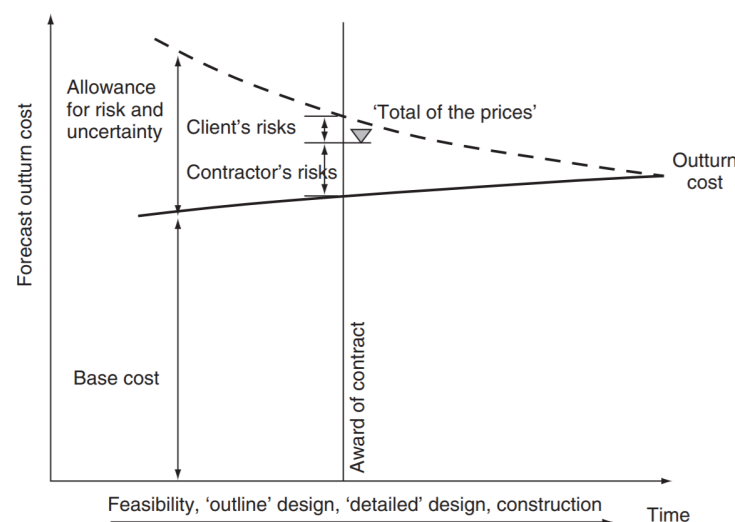


Figure 3: Cost implications of risk (Patterson, 2009).

Case Study: M4 Brynglas Tunnels Refurbishment

The Brynglas Tunnels carry the M4 motorway under Brynglas Hill in Newport, south Wales. A major NEC-procured refurbishment of the tunnels, as detailed in *Table 1*, was completed in 2018 to improve its resilience for the foreseeable future.

Table 1: M4 Brynlgas Tunnels refurbishment project brief.	
	Location: Newport, Wales
	Value: £34 million
	Contract: NEC Option C
	Start-Finish: 2016 - 2018
	Employer: Welsh Government
	Contractor: Costain

"The workshop enabled everyone to actively discuss the subject of risk and the many inevitable 'what-if' questions associated with a project of this criticality."

Weekly **risk reduction meetings** were held, in lieu, the NEC risk register was updated daily to include a record of all discussions held in relation to each early warning. Project Manager Simon Dean concluded that the collaboratively administered project in line with NEC principles set a stead for success, stating:



"Rather than risking a hostile relationship between those who have to manage and implement the contract, our strategy bonded all parties as the project evolved."

Project highlights:

- The NEC requirement to work in a 'spirit of mutual **trust** and **co-operation**' has led to a **collaborative** approach on this complex, motorway refurbishment project.
- NEC risk management and **early warning processes** ensured that restrictive night-time working stayed **on schedule** and with minimum disruption to traffic.
- NEC processes helped to ensure **transparency** of all risks presented.

Case Study Synopsis

In the specific context of risk, NEC contracts allowed the client to implement any procurement and contract strategy desired and to allocate risk in the contract to both **clearly** and **flexibly** suit its objectives. The clarity of risk allocation was important in the **avoidance of disputes**. The early warning process and risk register were **simple** but effective risk management tools to encourage the **ongoing assessment and management of risk throughout** the contract; moreover, improving productivity.

References

Cooke, B. (2013) *Construction Planning, Programming and Control*. John Wiley & Sons, p. 504.

Dean, S. (2018) *M4 Brynglas Tunnels refurbishment*. NEC. Available at: <https://www.neccontract.com/NEC-in-Action/Case-Studies/M4-Brynglas-Tunnels-refurbishment-Wales-UK> (Accessed: 22nd May 2020).

Patterson, R. (2009) *Using NEC contracts to manage risk and avoid disputes*. ICE. Available at: <https://www.neccontract.com/getmedia/911bd7ed-9984-49c4-9c9e-d355b49f8326/R-Patterson-Risk-paper-MPL-Nov-2009-as-on-NEC-website-Feb-2019.pdf> (Accessed: 22nd May 2020).



How the monitoring, testing and commissioning of large buildings should be managed.

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The process of commissioning is a vital ingredient within the construction process to permit the success of a project, ensuring that services are in **good working order**. Commissioning takes place **throughout a project**, from the RIBA Design Stage to Handover. Defined in Figure 1, generally, commissioning is carried out in **five distinct parts**.

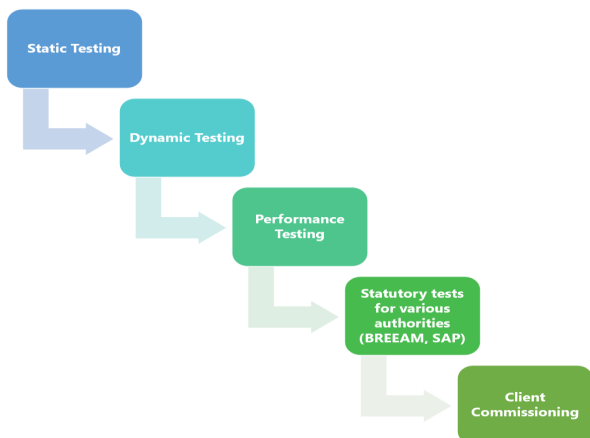


Figure 1: Five ingredients of commissioning.

Once all commissioning related activities have been identified (see Figure 2) the **commissioning programme** can be built up using knowledge, timescales and dependencies obtained from the individual specialists.

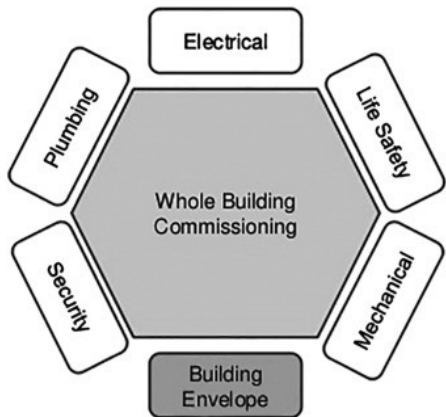


Figure 2: Scope of commissioning (CIOB, 2019).

Commissioning Strategy and Schedule

On larger projects, the prospect of procuring a **commissioning contractor** is commonplace. This specialist contractor can be brought into the project **early** with the added benefit of giving **greater control and transparency** across the whole construction process. It is likely that the commissioning contractor will employ the testing, commissioning and performance testing flow chart on Figure 4. Following this standardised process will ensure that the upmost **quality** is preserved along with **Health & Safety** assurances. This procedure is formulated as part of the **'snag & clean'** operation, defined as:

"The process of inspection necessary to compile a list of minor defects or omissions of building works for the contractor to rectify" (RICS, 2019).



Figure 3: Commissioning contractor (BSRIA, 2017).

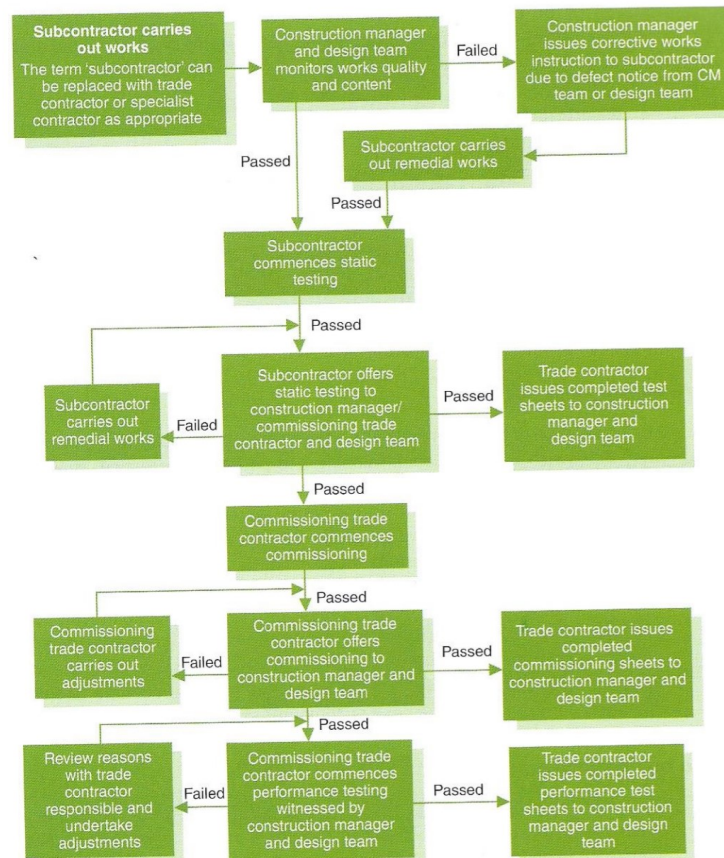


Figure 4: Large project installation testing, commissioning process and sign-off (CIOB, 2019).

O&M Manual, Certificates and Warranties

Closing in on building handover, the formulation of an **Building Owners Manual** (O&M) is legally required under the **Construction (Design & Management) Regulations 2015**. Enclosed within this document are

- Details of construction (cladding, roof etc).
- As-built drawings and specifications.
- Instructions upon operation and maintenance
- Commissioning and testing results.
- Guarantees, warranties and certificates.

Case Study: Edge Hill University, Lancashire

In 2015, Edge Hill University appointed a specialist consultant to oversee the commissioning and handover of their Faculty of Health building, and also to monitor the production of the O&M manual. The specialist had a data



Figure 5: Faculty of Health building (Edge Hill University, 2017).

The monitored data is reporting average energy consumption lower than the good practice benchmark in

the **CIBSE TM46 Energy Benchmark** (see Figure 6).

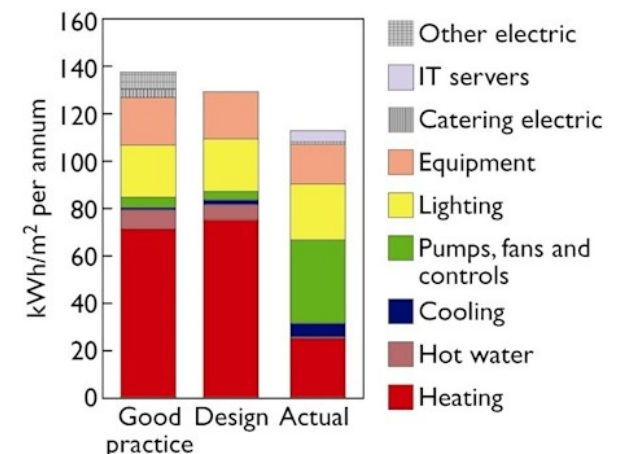


Figure 6: The Faculty of Health, Edge Hill University lower than average energy consumption (BSRIA, 2017).

During commissioning, there were **good co-operation** between the commissioning consultant, the services consultant, the main contractor, and the principal sub-contractors. This resulted in a **smooth handover** and **swift resolution of defects**. The project also benefited from a well-informed client with a good relationship with the design team. The arrangement has allowed for **lessons learned** to be passed on to newer buildings. Post-commissioning issues have been dealt with quickly as the parties are still in regular contact.

Case Study Synopsis

Building services can represent more than 30% (CIOB, 2014) of a projects capital cost. Therefore, the inclusion of a **BIM strategy** on this case study could have majorly enhanced the commissioning

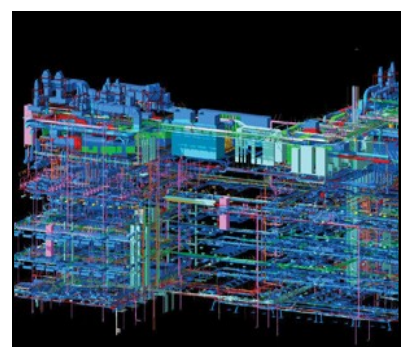


Figure 7: BIM in commissioning (Morton, 2018).

process of these services. Permitting the commissioning contractor and the operational team to get involved as early as needed; through having **access to a model BIM will connect data to processes and connect people to those processes at the right time**.

Triangulating BIM practices with **'Soft Landings'** framework, planning for handover and commissioning can begin very early throughout the project.

"The term 'soft landings' refers to a strategy adopted to ensure the transition from construction to occupation is bump-free" (BSRIA, 2017).

References

BSRIA (2017) *Commissioning and handover case study - Edge Hill University*. Available at: <https://www.bsria.com/uk/news/article/commissioning-and-handover> (Accessed: 21st May 2020).

Goodwin, W. (2019) *Code of Practice: Project Management*. Chartered Institute of Builders (CIOB). Wiley Blackwell, p. 331.