EXPRO National Manual of Assets and Facilities Management

Volume 4, Chapter 2

Financial Planning – Design Reviews

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1.0 PURPOSE

The purpose of this document is to help Entities understand the importance of Design Reviews (DR), in relation to Asset Management Financial Planning. It shall direct users in the development and implementation of a DR procedure, to enhance the design criteria of an asset in becoming consistent with the Entity's Asset Management framework.

A DR is a systematic and recorded review of a concept to assess its capacity and suitability to meet its needs. An analysis of the design also helps to recognize current and future issues from a financial risk perspective to the Operation.

This document provides links to financial planning when considering the design features, functions, inputs, processes, Operations and Maintenance (O&M), deliverables from concept, down to the retirement-stage of an asset.

The Entity shall apply the DR process to any new asset, and when planning use of existing assets.

2.0 SCOPE

The Entity is to develop, adopt and deploy a standard DR procedure applicable to all tangible assets at any stage of their lifecycle, with considerations to financial planning. The Entity's scope during the process of DR shall align with features and design criteria to comply with the Entity's polices, scope, planning and implementation, objectives, the conformity with the asset register (AR), and O&M requirements, down to decommissioning and disposal.

The DR procedure can be applied at any stage during an asset's lifecycle, including the disposal stage. Despite being associated with physical assets, the DR can also be applied to processes and procedures, as well as documents and IT systems. The primary function of a DR is to optimize value through improving efficiency and value, in terms of Asset Management (AM).

The DR process has a broad scope in usage, and should be accepted by all accountable managers as an essential aspect of their role in maintaining the suitability and functionality of assets, processes, and systems in their remit, and with regard to financial planning.

The DR does not supersede or replace other design aspects such as material selection, technical specifications, and economic design decisions. Instead, it compliments these design aspects by adding, substituting, or sometimes deleting another dimension related to requirements of Asset Management, such as operations, maintenance, and service delivery in general. DR as expressed in this document, shall have a positive impact on the operational costs, and ultimately the whole life cost of the assets in question.

In the context of Volume 4 – Financial Planning and the NMAFM, the DR considers the asset's operational integration from a design point of view. It does not include the review of design from an engineering perspective. Therefore, DR excludes the following:

- Building and infrastructure engineering design and specification design, that shall conform to applicable standards and building codes.
- Architectural designs made to meet artistic concepts or cultural representations.
- Compliance of the design with regulatory requirements.

3.0 DEFINITIONS

Term	Definition
Asset	An Asset is an item, thing, or entity that has potential or actual value to an organization. The value will vary between different organizations and their stakeholders, and can be tangible or intangible, financial, or non-financial.
Asset Management	The coordinated activity of an organization to realize the full potential of any asset.
Asset Management System	Set of interrelated or interacting elements to establish Asset Management Policy, Asset Management objectives, and processes to achieve those objectives. (i.e. management systems for the management of assets).
Asset Management Policy	A short statement that sets out the principles by which the organization intends to apply the Asset management system, to achieve its organizational objectives.
Strategic Asset Management Plan (SAMP)	Documented information that specifies how organizational objectives are to be converted into Asset Management objectives, the approach for developing Asset Management plans, and the role of the Asset Management system in supporting achievement of the Asset Management objectives.
Asset Management Objective	Derived as part of the SAMP are the aligned activities set by the Entity, consistent with Organizational Objectives and Asset Management Policy to achieve specific measurable results. It provides the essential link between the organizational objectives and the Asset Management Plan (AMP), that describe how those objectives are to be achieved.
Asset Management Plan (AMP)	Documented information that specifies the activities, resources and timescales required for an individual asset, or a grouping of assets, to achieve the organization's Asset Management objectives.
Asset Management Process	The method used to implement an Asset Management System.
Enterprise Asset Management System	The process of managing the lifecycle of physical assets and equipment, in order to maximize its lifetime, reduce costs, improve quality and efficiency, health of assets and environmental safety.
Asset Management Software (AMS)	Also known as an Asset Management tool or solution, it is a dedicated application that is used to record and track an asset throughout its lifecycle, from procurement to disposal.
Computerized Maintenance Management System (CMMS)	Is a software package that maintains a computer database of information about an organization's maintenance operations.
Asset Lifecycle	The phases an asset transitions through, from inception to disposal.
Asset Register (AR)	A list of all assets, often computerized, that contains pertinent details about each asset to track the value, physical location, operating cost, condition, utilization, and all other details necessary to better manage the asset.
Condition Assessment (CA)	The process of periodic physical inspections, assessments, measurements, and interpretation of the resultant data, to indicate the condition of a specific asset.
Design Review (DR)	A DR is a systematic and recorded review of a concept to assess its capacity and suitability to meet its needs
International Standards Organization (ISO)	The international standard-setting body, composed of representatives from various national standards organizations.
Lifecycle	The cycle of activities that an asset (or facility) goes through while it remains an identity as a particular asset, i.e. from planning and design, to decommissioning or disposal.
Linear Asset	Linear Assets often connect with each other, defined by the length (or area) and are often part of a network, i.e., rail lines for trains, water pipes for water, and roadways for cars.

Term	Definition
Non-Linear Asset	Non-Linear assets occupy a specific space and can be tracked by their location. (Buildings, Offices, Plant and Equipment).
Quality Management	Quality management is the act of overseeing all activities and tasks needed to maintain a desired level of excellence.
Strategic Plan	A plan containing the long-term goals and strategies of an organization.
SME	Subject Matter Expert

Table 1: Terms & Definitions

4.0 REFERENCES

- ISO 55000:2014(E) Asset management – Overview, principles and terminology, International Standards Organization (ISO)
- ISO 55001:2014(E) Asset management – Management systems – Requirements, International Standards Organization (ISO)
- ISO 55002:2014(E), Asset management – Management systems – Guidelines for the application of ISO 55001, International Standards Organization (ISO)
- ISO 41001:2018 Facility management — Management systems — Requirements with guidance for use, International Standards Organization (ISO)
- ISO/TS 55010:2019 Asset management — Guidance on the alignment of financial and non-financial functions in Asset management, International Standards Organization (ISO)
- ISO/CD 55011 Guidance on the development of government Asset management policy, International Standards Organization (ISO), (under development, to be considered as a future reference), international organization
- ISO 9000(en): 2015 Quality Management Systems

5.0 RESPONSIBILITIES

Role	Description
Entity Asset Management System Teams	Entities' Asset Management teams shall be established and be mandated by the Entity's leadership, to adopt and undertake full ownership of the structuring of an effective and applicable Asset Management System for the Entity. The process will be achieved by following the guidelines, manuals, and procedures as provided within the NMAFM system. The Entity's Asset Management System team in each Entity, shall take the lead within its Entity to effectively and positively develop the Asset Management System's transformation and implementation.
Entity	Each Entity will have the following responsibilities and be accountable for: • Developing, deploying, and monitoring the Asset Management System, designing the inter-organization interface across the Entity to manage assets and asset' systems and risks, across their lifecycle. • Establish standards and performance measures for the Asset Management System and Entity-specific management systems. • Responsible for developing the risk management system for all the Entities conforming to Saudi Law, industry-specific regulation, and risk appetite of the Entity. • Prepare plans for appropriate Condition Assessment (CA). • Ensure that Condition Assessment is aligned with Government Regulations and the details laid out in Volume 3 of the NMAFM. • Identify or source the appropriate resources to carry out the Asset Management System tasks.

	• Train or brief (whichever is more appropriate depending on resources selected) the selected resources, to ensure uniformity across all asset categories and conformity to the NMAFM. • Assist in the compilation of the Condition Assessment Report, particularly in the prioritization of assets and possible future requirements for the use of assets. • Plan and implement recommendations established by the Condition Assessment Report. • Establish Entity Specific Asset Management Stewards and Entity Champions to accelerate and deploy asset policy. • Establish Entity Specific Asset Data Management Stewards and Entity Asset Data Champions to manage data quality to the highest standards.
Entity resources or Outsourced contractors	• Understand, develop, and prepare Asset Management System requirements to undertake the development of Policy, Scenario modeling and, address the complexity of work for each Entity. • Provide and train competent and authorized personnel to empower and steward champions in support of the implementation of Asset Management System design. • Follow agreed procedures and commit to project timelines. • Carry out job risk assessments, support the development of methods statements, and support Risk Assessment Management System RAMS (Risk Assessment and Method Statement) across the Entity. • Provide a detailed report and advice based on facts and evidence, in collaboration with the Entity.

Table 2: Responsibilities & Accountabilities

6.0 PROCESS

Figure 1 (below) shows the stages of the financial planning process as described in Volume 4 of the National Manual of Assets and Facilities Management. DR is in Phase 2 of the process.

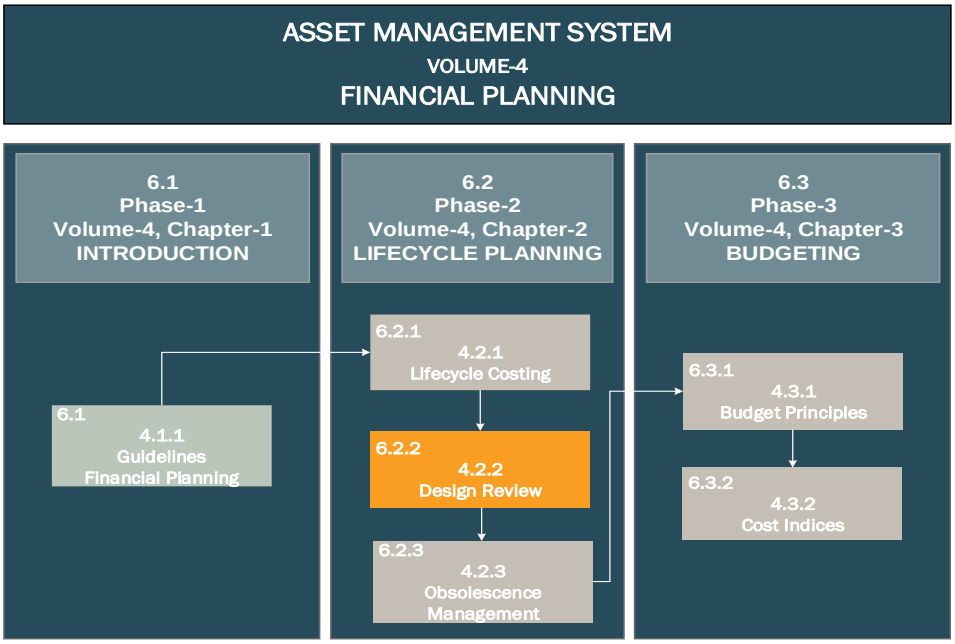

Figure 1: Phases to formulate Financial Planning for Assets.

In Asset Management terms, DR are commonly viewed as being managed by Project Managers and Designers/Architect; however, this is not the case here. A responsible Asset Manager should view DR as an essential element to effective AM, due to the associated and proven Return on Investment (ROI). Wherever possible, the Asset Manager will engage the Facilities Management (FM) team in this activity, in order to access practical advice, in relation to the operability of the design of the assets being reviewed.

6.1 Guidelines, Financial Planning

The Asset Financial Planning Guideline, EOM-ZL0-GL-000001 is found at the start of Volume 4 and gives Entities an overview of the Financial Planning process.

6.2 Lifecycle Planning

6.2.1 Lifecycle Costing

The Asset Financial Planning Procedure, Lifecycle Costing, EOM-ZL0-PR-000002 is found in Volume 4 and DR is a key component, which supports Lifecycle Costing.

6.2.2 Design Review (DR)

It is already established that DR has a broad scope in relation to AM, however, it is essential to understand the scale of benefits depending on when a DR is initiated, within an asset's lifecycle. Figure 2 (below) illustrates that, the earlier the intervention in an asset's or system's lifecycle, the greater the rewards are to the operation, and a reduction on the financial burden to the owner. By understanding this opportunity, Entities will ensure that their constructed assets are not only optimizing capital expenditure and engineering output, but also addressing an end-user and operational perspective, that is often ignored.

The greatest opportunity to secure future efficiencies in the O&M of assets, lies in the design stages. It is in these early stages where key decisions are made on issues such as logistics, access provisions, utility services, and material specifications. Timely operational input can have a significant impact on the future operating costs and whole life value of an asset, as well as optimizing its functional value.

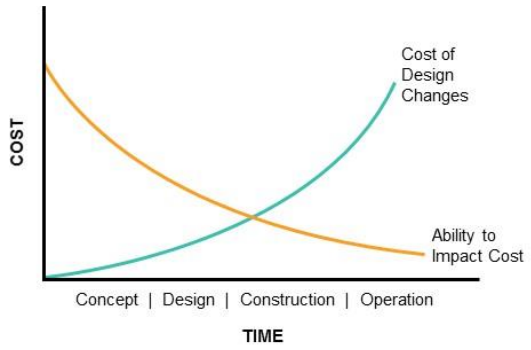

Figure 2: The Impact of Changes on Design

DR provides operational insight into the early phases of asset creation or upgrade. This insightful input comes from the operators of assets, such as plant managers/operators, maintenance engineers, planners, asset performance officers and so forth. These groups of contributing professionals have an accumulated wealth of knowledge concerning asset function, and subsequent delivery of services.

Those contributors can provide several benefits that inform and optimize the design process, and ultimately do the DR of the new or existing asset, to confirm the following:

- Assets that are a better fit to the business needs.
- Assets that are easier to test and commission, or to operate and maintain.
- A more cost-effective lifecycle plan for the assets.

- Assets that are more suited to the needs of the end user (who receive the service).
- Contribution to improving the reputation of the Entity.
- A safer and healthier design.
- A flexible design that can adapt better to changing needs.
- Efficiency in terms of energy needs and usage.
- Ease of constructing and fully integrating, since it fulfils end-user needs.

An operational DR assesses the asset from a 'Whole Life' perspective, targeting the impact of design decisions on the operational phase. In an Asset's Lifecycle, the O&M phase is usually the longest phase and therefore, it usually accounts for the highest costs in the lifecycle.

An Asset's Lifecycle consists of four distinct phases as shown in Figure 3 (below), which can be subdivided into further stages. (For more information on the Asset Lifecycle phases, refer to NMAFM Volume 2 – Asset Management procedure EOM-ZA0-PR-000006).

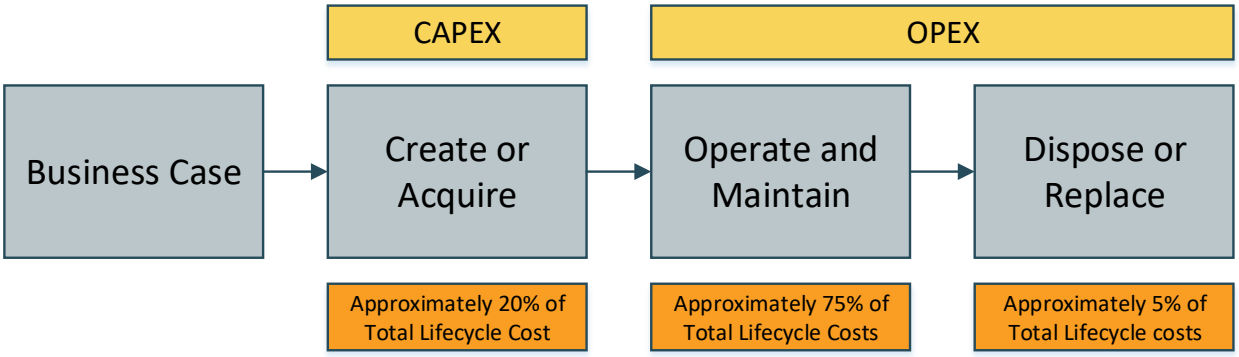

Figure 3: Asset Lifecycle – Approximate Proportions of Costs

The process of development, adoption and implementation of the DR shall accompany the Asset Lifecycle, in all four phases as shown below:

6.2.3 Business Case (Phase 1)

During this phase, the Entity's Planning Department shall formulate a DR process and apply it internally or by an outsourced expert. The process shall be formulated to achieve the following:

- Assess and assign the SMEs resources managed under the Entity, and its capacity to deliver the required DR procedures and processes.
- SMEs shall review the mandated mission of the Entity, and assess the required deliverables of the new assets at the planning stage, including metrics and measures in terms of numbers, units, rates, serviced clients, amounts, volumes, processes, counts, to become the basic guidelines for the DR procedure.
- Collect data and trends of previous delivered assets, and the level of previous designs to meet the required services.
- Collect and confirm features of assets to meet the future demand forecast, for the Entity's deliverables.
- Conduct plans to draw guidelines for asset standards, codes and unique features at concept stage or down the line to do asset upgrades, renovations, additions required, or assets to retire, to cope with the future demand forecast. SMEs shall take into consideration variable aspects of delivery time, construction time, and all the financial requirements to incorporate within the Entity's financial plan, so as to create a string of the design planning at concept stage, to feed to outsourced planners and contractors.
- The asset planning team shall establish, as part of this process, the DR stage for Phase 1 of this planning process. The DR shall be conducted on a continuous basis to critique and optimize the designed processes for incorporation within the Asset Demand Forecast plan, and the Entity's financial plan.

6.2.4 Create or Acquire (Phase 2)

The Creation/Acquisition phase includes the capitalization of a best value asset which conforms to all foreseeable Asset Management requirements, up to asset retirement. In this phase and sub-phases during the design processes of the concept (pre-design, and design stages that are related to the realization of the asset), it will be most important to design the DR process and implement it as thoroughly as possible, so as to ensure the asset serves its purpose.

During this phase, before the asset has been commissioned, is when the most benefit can be realized from a DR. Approximately 20% of the total asset's lifecycle value is realized during the acquisition phase; so it is vital that the Entity maximizes the opportunity to influence both the planned CAPEX, and calculated OPEX spending at this stage.

In some cases, an asset may have existed outside the control of the Entity. In such a case, the influence that a DR can have without incurring large costs is lessened, as the asset is already beyond design stage. Nonetheless, as a DR can still be applied at various stages of the Asset's Lifecycle, with varying degrees of effectiveness and efficiency, it is still a valuable approach to consider.

Building Information Modeling (BIM), can be utilized as a part of the engineering planning and design criteria. It can also be aligned to use and conform to an Entity's standard codification and applicable hierarchy structures, standards, and procedures. BIM can be applied from concept stage, with initial design data updated during construction. The final details of all asset components and elements will be incorporated into the 'as-built' BIM model, which shall become part of the AR system, and shall help in conducting a future DR, at any stage in the asset's life.

Another tool used during initial design, is Value Engineering (VE). Such a process once implemented within the DR prior to realization of the asset, should help in conducting investigations and analysis during the design or construction stages, to suggest making substitutions to, or eliminations of design elements, to lower the costs of the asset acquisition while maintaining functionality.

For existing assets transferred to the Entity, with little or no information of design and functional details, the DR must be established and conducted to possibly make the required alterations, and bring this asset into conformity with the guidelines of the Asset Management System.

With increasing levels of complexity and asset sensitivity; the Entity's DR may go as far as to utilize Laser Scanning techniques, which is a relatively new and precise, survey technology. Now, it is quickly becoming one of the industry standards as a way to make very accurate measurements in complicated environments. This is precisely why using this technology is used as a solution for measuring 'as-built' conditions inside and outside, an existing asset. This instrument collects survey data points at high rates of capture, with several "scan" setups inside of a room or a building, and a complete 3D model can be made of the existing configuration. These models are then used to create 2D civil, architectural, mechanical, electrical or instrumentations and control drawings, 3D computer models, and final survey documents.

Entities may use these or other techniques to assist the reviewer in performing DR, for new or existing assets. Even at later stages when an asset is already in operation, the measurement and capturing of operational data and the analysis of that information, can assist in informing DR for all assets within the Entity's asset portfolio, to continually improve and serve the Entity's needs.

Figure 4 (below), demonstrates the high-level DR process and the inter-relationship with Change Control and Change Management. The outcomes of each stage shall be assessed to be weighed and measured in financial terms to reflect costs. Thus, these DR processes will serve as key elements to feed into the financial planning and help make sound justifications for incorporation into current, and future budgets.

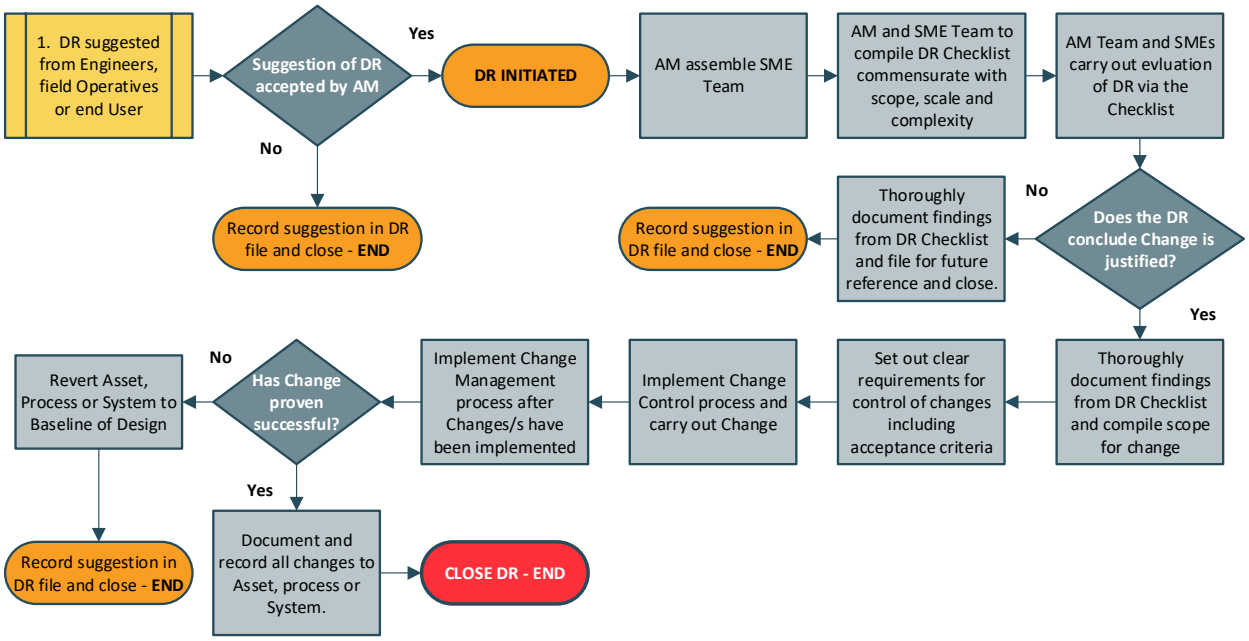

Figure 4: DR Process.

6.2.5 Operate and Maintain (Phase 3)

Whether the asset is new or previously built, or needs to have its purpose changed, the Entity must still design the appropriate DR process and make it relevant to the O&M functionality.

The Phase-3 DR process shall include:

- A specialized SME team from the Entity's O&M members of engineers, operators, or end-users, who shall be assigned to the DR process.
- The Process shall be established to address the newly acquired or existing, operating, or non-operating asset's design features. This shall include all aspects of:
    - Functions, inputs, processes, outputs and deliverables, reliability, risks of failure, new technologies, capacity to meet the current and future requirements in view of the planned future demand forecast, environmental impacts, energy consumption, ability to connect to the asset portfolio, and complementary requirements.

Asset DR shall conform with related Entity policy, regulations, and rules. All investigated elements and features at Phase 2 shall satisfy the required asset purpose to deliver sustainable services at optimal performance levels. These can be compiled in a checklist format to each design aspect: civil, mechanical, electrical, instrumentations and control, substructure, superstructure, finishing and decorative elements, equipment, and plant.

All DR assessing measures shall be weighed in terms of the asset life cycle costing concept, and be considered in the financial planning and financial policies, while maintaining the ability to manage the assets within the context of Asset Management principles and intent.

For implementation purposes, the formulation of the DR process for Phase-3 shall take into consideration the successful process of conducting the DR, as per Figure 5 (below).

In Phase 3 there should be clear benefits resulting from undertaking DR. However, there are also challenges to performing the DR. It is important to understand these challenges to allow Entities to address them accordingly. They include:

- A disconnect between the various teams working on an asset throughout its useful life (the "Silo" effect). This occurs across most teams, with the biggest impact being the distancing of the end user/operator, from the original designers.

- An underestimation of the value that an operational DR will provide.
- Cost barriers – this will involve additional funds allocated to the person or organization conducting the DR.
- A difference in the operating culture of designers, contractors, operators and end-users.

Most of these can be overcome, or minimized, through communication and a mutual understanding of the benefits of DR. Acknowledging that these challenges are present is the first step in overcoming them, in order to realize those benefits.

The following criteria will generally increase the need and potentially highlight when a DR would be a beneficial activity to carry out:

- A higher degree of complexity of the asset or facility.
- A higher than average number and type of end-users.
- High criticality of the asset or Facility.
- Change in use profile of the asset or Facility.
- A design change to all, or part of the asset or Facility
- Major works planned to change existing system's configuration.
- An unacceptable level or drop in performance/output.
- Asset, facility, or system load balancing issues.
- Inclusion of new assets that interface with existing assets.
- Anything else that changes the user/asset interface, or a relationship which creates operational and/or financial issues.

Irrespective of whether any of the above criteria has occurred, in the interest of operational process awareness, it is recommended that a review of the previous DR findings be carried out at least once a year, per Facility. The process should be assigned an owner and local experts who are responsible in maintaining the DR records and the updating of key stakeholders contact details, in readiness for conducting a DR. It also gives O&M the opportunity to understand the DR process in readiness for the next occasion it has to be carried out.

The requirement behind this review is to clarify and justify a need for a change to an asset's, or asset system's baseline of design, and therefore the process shall be combined with the change control and management process, to ensure any risk is mitigated.

During the O&M phase of the lifecycle, DR will be initiated primarily via reliability, availability, and maintenance (RAM) data, and also from operational issues fed back from operational staff or end users.

As with any form of Configuration Management the inclusion of SME in the process is important to ensure the depth of competence is sufficient to critique the DR effectively and thoroughly.

If the asset or facility is operational, i.e., beyond the commissioning phase, then responsibility rests upon the Asset Manager to initiate a DR. As with attendance at a Concept Review, all interested stakeholders shall be given the opportunity to make clear what their suggestions are, and what they believe the benefits are likely to be. It is critical that all suggestions are recorded accurately, and that a feedback process is utilized to conduct an upper level risk assessment that inform of the progress of any suggested changes.

It is also imperative that any adopted changes are subject to a strict Change Control and Change Management process to mitigate any potential for safety or financial risk implications.

On completion of the DR checklist, the results will aid the decision whether to carry out any changes or improvements to existing designs and/or configurations. In the event that changes are recommended or not, the recording of the process is critical in the interest of control, and for future reference.

6.2.6 Dispose or Replace (Phase 4)

End of the Asset lifecycle. The process to just dispose, or dispose and replace an asset, may seem simple and straight forward with little complication. For the Asset Management team however; a DR process shall apply with consideration to review every step listed below:

- Conducting a site survey against a defined scope including:
    - All legal aspects, permits, authorizations and approvals, decommissioning and isolation, demarcation and applicable safety requirements, and implementation and any further mobilizations.
    - Contractual aspects to outsourced services providers; this requires defining the planners, designers, project management, various engineering tracks services, such as electromechanical, environmental, traffic, transportation and risk assessments, municipal services to dispose of, and use of landfills, recycling plants, incinerators, waste management, utilities, health services and civil defense.
    - Specialized contractors to dismantle, demolish, to do rigging and carriage/transportation, cleaning, and segregation, excavation, and refilling.
    - Construction contracts.
    - An internal SME to represent the Entity.
- Plan and design a process to decommission, dismantle and dispose of, the existing asset.
- If replacing an existing asset, a complete design, planning, and engineering study is to take place.
- The new project shall undertake the integration process for a new asset; prepare the infrastructure, substructures, foundations, buildings including auxiliaries and terminations, with related functional or standalone assets.
- An Asset Financial Plan shall be established, including the complete budget and cash flow to financially control the project.
- Project initiation with related DR, contract management, tendering and contract signing process precedes the project kick-off.
- If relevant, the snagging and commissioning of a newly structured/supplied replacing asset, shall be performed.

a. The new asset shall be handed over to the O&M, for business as usual.

DR shall be applied at each stage of Phase 4. Close control of reporting any issues at each stage shall guarantee the delivery of sustainable services, within acceptable quality and performance levels.

The general checklist in the attachment below, sets out the scope of a typical DR.

7.0 ATTACHMENTS

1. EOM-ZL0-TP-000001 – Design Review Checklist

Attachments 1: EOM-ZL0-TP-000001 - Design Review Checklist

Design Review Checklist	
Checklist Description: This checklist captures common elements that should be present in any design. Throughout the Design Review process, it is presented to inspire reflection, direct brainstorming, and to ensure that all necessary design requirements are included in the design mentioned. While the project architecture, system and application design are being evaluated, identify the design criteria that contribute to your business / technical knowledge, and needs.	
Project Name:	**Review Date:**
Assessment and Recommendations: ☐ Approved without revision ☐ Approved with revisions ☐ Not approved	**Notes:**
Reviewer:	**Signature:**
Artifacts reviewed: ☐ Technical Design Specification ☐ Implementation Plan	☐ Conceptual Architecture Review checklist ☐ Requirements Traceability Matrix

General Design	Comments
☐ Does the design support both product and department goals?	
☐ Is the proposal feasible from the point of view of technology, cost, and schedule?	
☐ Have known design risks been identified, analyzed, and planned for, or mitigated?	
☐ Do the methodologies, notations etc., help to build and capture the design?	
☐ Where possible have proven past designs been re-used?	
☐ Does the design support proceeding to the next development step?	
☐ Have appropriate fallback considerations been made?	

Design Considerations	Comments
☐ Does the design demonstrate conceptual integrity i.e. compatible with all sub-systems?	
☐ Can the concept be implemented within constraints of technology and the environment?	
☐ Does the design use standard techniques, and avoid exotic and hard to understand elements?	
☐ Is the design unjustifiably complex?	
☐ Is the design lean i.e. are all components and parts involved strictly necessary?	
☐ If appropriate, does the design create reusable components?	
☐ If appropriate, will the design be easy to transport to another environment?	
☐ Will the architecture permit scalability?	
☐ Are time-critical functions identified, and timing criteria specified?	
☐ Are the hardware environments completely specified, including changes to the scope of engineering?	
☐ Were the software / firmware prerequisite and co-requirements clearly defined, including release rates and restrictions?	

Requirements Traceability	Comments
☐ Does the design address all issues from the requirements?	
☐ Does the design add or remove features or functionality, which were not specified in the requirements?	
☐ Have requirements been documented with a completed matrix?	
☐ Are all assumptions, constraints, design decisions and interdependencies documented?	
☐ Have all reasonable design alternative been considered, including processes in software?	

☐ Has it outlined all the priorities, trade-offs, and decisions?	
☐ Have any new risks posed by the design been registered?	
☐ Have all systems with interfaces been identified?	
☐ Are the back-up and error recovery requirements completely defined?	
☐ Have the infrastructure e.g. back-up, recovery, checkpoints been addressed?	
Consistency	**Comments**
☐ Does the design properly fix problems previously established and deferred to upstream levels?	
☐ Is the design consistent with associated artifacts i.e. other designs and modules?	
☐ Is the design consistent with the development and operating environment?	
Performance Reliability	**Comments**
☐ Are all assumptions, performance attributes and constraints clearly defined?	
☐ Where appropriate, are there justifications for design performance i.e. prototyping critical systems?	
Capacity Planning	**Comments**
☐ Does the design improve or enhance productivity?	
☐ Is scalability developed into the plan and is it feasibly maintainable?	
☐ Is Total Cost of Ownership (TCO) increased, reduced, and controlled?	
Maintainability	**Comments**
☐ Is the design easier to maintain?	
☐ When recycled parts of other designs are used, is their effect indicated on the design and integration?	
☐ Does the design resist erosion, corrosion, or any other form of degradation?	
Compliance	**Comments**
☐ Does the design follow all relevant standards necessary for the system?	
☐ Have all legal and regulatory requirements been assessed and accounted for?	
Modelling and Design Reviews	**Comments**
☐ Are there numerous, consistent, models and/or views representing the design i.e. static versus dynamic, if appropriate?	
☐ Where there are multiple software models i.e. static and dynamic, are those models consistent?	