



DNZ

HS08-01 Safety In Design

Relating to Standard: HS08 Safety In Design

December 2018

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1 Background and Purpose

The purpose of this procedure is to set out DNZ process for effective management of hazards and their associated risks. DNZ recognises that the systematic identification of hazards and the management of related risks arising from our operations is vital to the health and safety (H&S) of our personnel, suppliers and the public.

The New Zealand Health and Safety at Work Act 2015 (HSW Act) states that all organisations are required to:

- Identify hazards;
- Assess the risks if necessary;
- Control risks; and
- Review control measures regularly.

In addition to meeting these obligations, DNZ believes that the proactive management of hazards and risks is the first step in incident and injury prevention.

Safety in Design (SID) is a procedure that integrates hazard identification and risk assessment methods early in the design process. The procedure considers how to eliminate, isolate or minimise the risks of death, injury and ill health to those who will construct, operate, maintain, decommission or demolish an asset.

SID begins in the conceptual and planning phases of a project. The emphasis is on making the right choices about the design as early as possible to enhance the safety of the project. These choices may include appropriate methods of construction, on-going maintenance provisions, or materials used.

Most construction safety risk mitigation is aimed at isolating, informing of or controlling the hazard. The opportunity to consider the life cycle of the project and involve decision makers in the early design stages to eliminate a hazard is invaluable. The earlier you can begin this process in the design stages, the easier it is to make changes that benefit everyone. The design stage offers the greatest opportunity to incorporate improvements that can produce time and cost savings over the life of the asset.

The hierarchy of hazard control when considering SID is shown below.

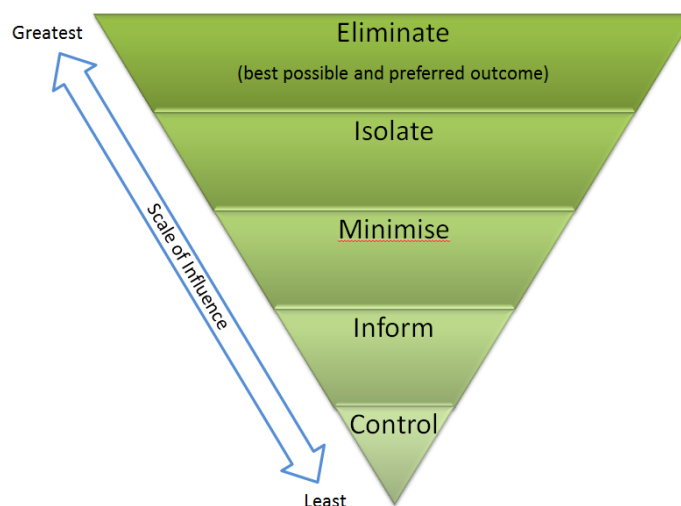


Figure 1. Hierarchy of Hazard Control

1.1 Why do Safety in Design?

Design evolves as part of an iterative process and intuitively designers should consider the life cycle of a project; from concept/feasibility to detailed design, buildability and then go on to consider the future use, maintenance and refurbishment/demolition of their project.

This thought process should not stifle innovative design. In fact, it is an opportunity for designers to stretch the boundaries of the industry to create practical pragmatic design solution. There are a number of reasons for following a safety in design process, including;

- a) Reducing the risk of directly, or indirectly, causing harm to people throughout the lifecycle of an asset.
- b) Continually challenging and improving designs.
- c) Changes made early in the design stage are more cost effective than retrofitted changes (to resolve issues) made during operation and maintenance.
- d) Better health and safety outcomes can be achieved by considering and reconciling the interests of different parties in an asset.
- e) Designers have a duty of care to create safe places to live and work.

1.2 Legal Requirements

The HSW Act requires persons controlling a business or undertaking (PCBUs) to ensure so far as is reasonably practicable the health and safety of their workers and workers whose work is influenced or directed by the PCBU. PCBUs must also ensure that the health and safety of other persons is not put at risk as a result of their activities. Part of this duty involves the PCBU eliminating or minimising risks arising from work.

PCBUs, such as DNZ, which design plant and structures that are to be used, or could reasonably be expected to be used, in a workplace, have a duty to ensure so far as is reasonably practicable that the plant or structure is designed to be without risks to H&S.

Section 22 of the HSW Act defines 'Reasonably Practicable' as something which is, or was, at a particular time, reasonably able to be done in relation to ensuring health and safety, taking into account and weighing up all relevant matters including:

- The likelihood of the hazard or the risk concerned occurring;
- The degree of harm that might result from the hazard or risk;
- What the person concerned knows, or ought reasonably to know, about the hazard or the risk and the ways of eliminating or minimising the risk;
- The availability and suitability of ways to eliminate or minimise the risk; and
- That after assessing the extent of the risk and the available ways of eliminating or minimising the risk, the cost associated with available ways of eliminating or minimising the risk, including whether the cost is grossly disproportionate to the risk.

A SID process aims to address the above matters by designing out safety risks where it is reasonably practicable to do so.

1.3 Benefits of a Safety in Design Approach

The benefits of embedding the principles of SID into the project life cycle include:

- a) Taking every opportunity to proactively reduce the risk of death, injury and ill health, during the life of an asset.
- b) Commissioning designs, that so far as is reasonably practicable, do not present a health or safety risk.
- c) Committing to designing out health and safety risk so far as reasonably practicable.
- d) Creating an environment for honest and open discussion amongst the wider design team.
- e) Committing to continual improvement and sharing of knowledge.

1.4 Principles of Safety in Design

The key elements that impact on achieving SID are:

- Consult, co-operate, and co-ordinate – use effective team collaboration to identify project health and safety risks so that all those involved with the asset are safe-guarded and understand the implications of decisions on others.
- Persons with Control - people who make decisions affecting the design of a project can promote health and safety at the source.
- Project Lifecycle - safe design applies to every stage in the project lifecycle - from concept through to disposal. It involves eliminating hazards and/or minimising risks as early in the lifecycle as possible.
- Systematic Approach - the application of hazard identification, risk assessment and risk control processes to achieve safe design.
- Safe Design Knowledge and Capability – people with control over design should either demonstrate or acquire the necessary safe design knowledge and capability.
- Information Transfer – essential for the safe design approach is the effective communication and documentation of design and risk control information, between those involved in each phase of the asset lifecycle.

2 Scope

This procedure applies to all those involved in the design process and to all phases of the design. As part of the design process, consideration must be given to safety and ill health throughout the life cycle of the asset. This includes reviewing how the asset can be constructed, operated, maintained, decommissioned or demolished safely.

This procedure is to be read in conjunction with the relevant DNZ Health and Safety Risk and Hazard Management Standard and any associated guidance and training material. It has been completed to align with DNZ's H&S framework.

3 Procedure

The process below sets out the steps to identifying, assessing and managing health and safety hazards and risks.

3.1 Project Life Cycle

The project life cycle is the process of managing the entire life cycle of an asset from concept, through design and construction, to operation, maintenance and decommissioning. The design team has various points throughout this cycle where it can influence the safety outcomes of the project, for example, from providing investigation information right through to end user specifications and demolition advice.

Below is a diagram showing the general life cycle of an DNZ infrastructure project, combined with a broad classification of the internal and external groups that interface at the various stages. Given the complexity of the DNZ organisation and the wide range of stakeholders it connects with, a diagram like this can never represent all interactions. However, it does demonstrate, at a broad level, the DNZ group that is likely to be responsible for a particular infrastructure asset at any given stage in its life cycle. In a general sense, the group responsible for the asset will coordinate any SID activities required during their ownership, whether that be the Capital Infrastructure team organising a detailed design SID review or the road corridor maintenance team coordinating a SID review on a road rehabilitation project.

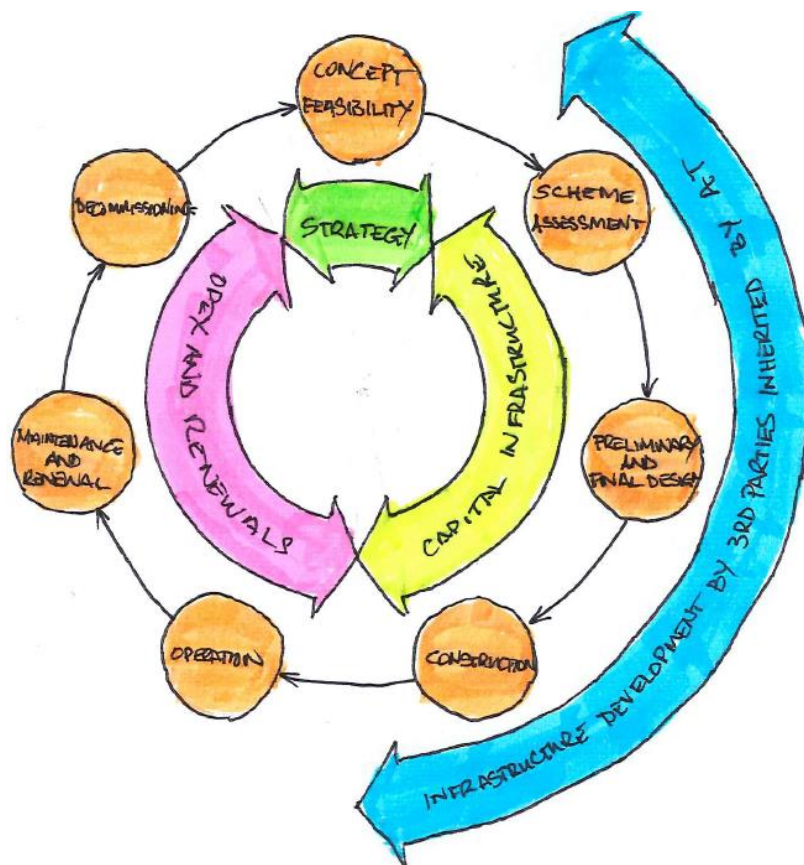


Figure 2. General Life Cycle of an DNZ Infrastructure Project

3.2 Design Team

The design team includes anyone who has control or influence over, contributes to, modifies, or has input into the design, construction and use of the infrastructure asset. As such, a design team can include any person from the asset owner, designer or contractor including people from communications, planning, commercial and financial teams.

3.3 When to Undertake Safety in Design

SID is a process that should happen all the time, running continuously throughout a project. SID Review workshops collate the thinking and are a key aspect of a robust SID process, but these should not be the extent of the process.

A robust SID process should seek to build a SID knowledge base in early project phases that can be handed over and built on in subsequent phases. At the concept the focus should concentrate on hazard identification, flagging key design risks, and suggesting further investigation. At scheme phase the focus moves to evaluating the key risks and designing out or around the big issues (e.g. identification and design out where possible). At detail design phase the focus shifts towards mitigation measures and eliminating/reducing residual risks and providing quality SID handover information that can be incorporated into the Contractor's Request for Proposal (RFP).

SID review stages should not be seen as rigid, as not all projects will follow the same procurement strategy and some projects may skip some of the development steps. As such, it is the responsibility of the DNZ project manager and the design manager to agree appropriate timings for reviews.

From a SID perspective, the earlier a review is undertaken the easier and less expensive it is to adopt design changes. To identify issues early, it is recommended that reviews are carried out at two stages (minimum) during the project development cycle. The first review stage should be early in the life cycle (e.g. at concept design stage) to either inform (or review) the preferred option before it proceeds onto final detailing. The second review stage should be during the final design phase as soon as enough information is available for discussion, and not too far along that it is difficult to make design changes (e.g. between 40-60% detail design). A SID review carried out at the very end of detail design should be avoided as it is often too late and impractical to make significant design changes.

The principles of SID apply to all procurement models. However, for some models (such as Design and Construct, Public–Private Partnerships and/or Alliancing), additional and more complex SID requirements may apply to the specimen design, pre-tender, tender (potentially multiple designs to review) and post-award stages. The DNZ project manager should outline the specific process to be followed for any particular project at the start of the project development cycle.

The number of review meetings undertaken at each stage will depend on the project's complexity. Large multi-disciplined projects that are complex (e.g. significant structures, tunnelling, etc.) may need to be broken into a number of discipline or area specific reviews. Simple projects that involve common construction and maintenance techniques may only require brief reviews at each stage.

The following diagram gives an indication of where specific SID review meetings could be held:

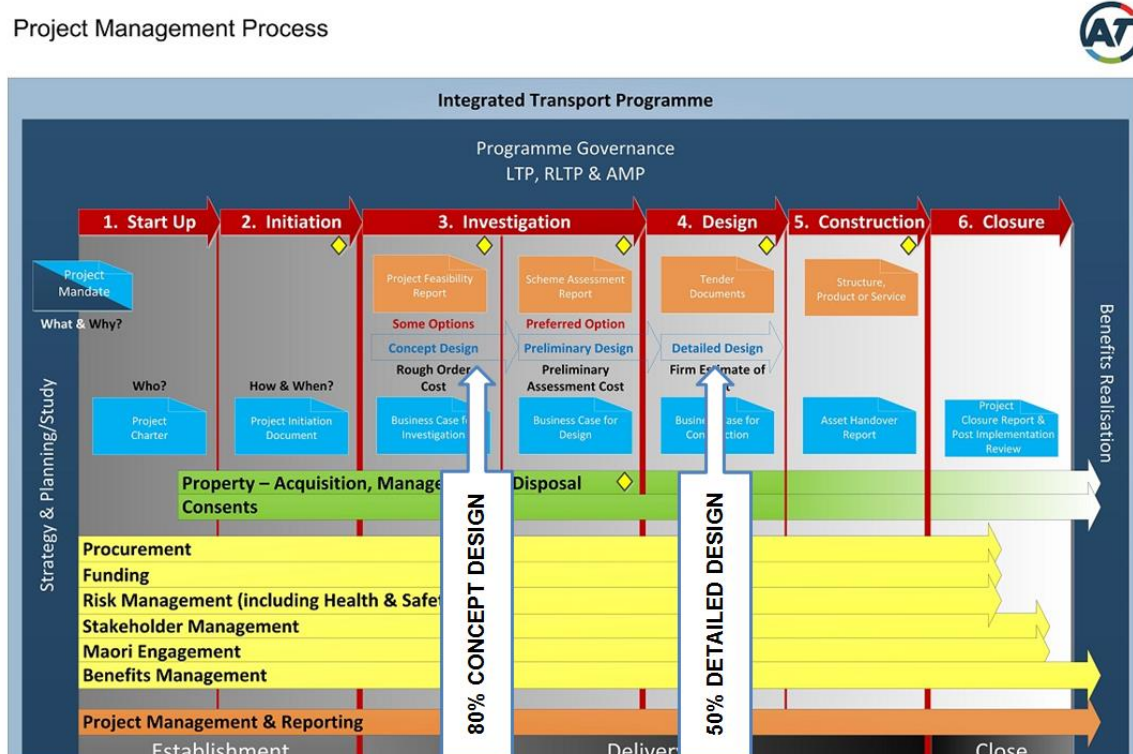


Figure 3. Project Management Process

3.3.1 Concept Design Stage

As the concept design is developed, thought should be given to any surrounding risk. This information, together with any existing information such as historical or general background and design requirements, should form a base for the first SID review.

Output from the SID reviews should inform decision making regarding which design option to progress, materials to be used or which construction methodologies are appropriate. It may also lead to additional investigation to fully quantify a particular hazard.

A communication plan with the project team should be developed at the onset of the project to capture concerns and agreements on how the design might be improved to make the project safer. Key points from the discussions should accompany the outputs from the reviews and form part of the briefing notes for the next design stage.

3.3.2 Detail Design Stage

When the detail design stage commences all prior SID documentation should be reviewed to ensure it is complete and understood. Detailed design SID review(s) can take many forms and at various stages through the design phase, but should be focused on construction hazards, maintenance and operational hazards, renewal hazards and demolition hazards.

The people on the ground doing the job every day must be included in this process. These are the people who have to construct, maintain, renew and operate the asset. These resources should not be overlooked but embraced and used to the fullest potential.

Designers should take the opportunity to visit similar projects to get an understanding as to what plant may be used during construction, how the site will look once it is operating, and how maintenance activities will be undertaken.

Output from the SID reviews should be included within the tender documentation to forewarn the contractor of the residual H&S hazards that need to be mitigated and to inform the development of appropriate construction methodologies.

3.3.3 Construction

A pre-start meeting is a good opportunity to discuss the SID documentation so that remaining safety risks are managed appropriately, and any design assumptions, specified materials and methodologies can be understood. Any feedback and lessons learned should be circulated back to the design team leader and DNZ project manager to ensure that future designs are improved.

3.3.4 Decommissioning

Decommissioning may be a distant prospect at the start of the concept design stage. Alternatively, it may be more immediate or even the specific reason for the project itself. This will influence the degree to which the design team can viably consider decommissioning aspects. Projects where decommissioning is an immediate concern, or where decommissioning is judged to become a challenging by-product of the project, should give careful consideration to this aspect during the review process.

3.3.5 Road Safety Audit

The Road Safety Audit process provides an operational, road-user focussed, view of the likely safety outcomes of design decisions. It is a valuable input to the SID process. Road safety audit outcomes ideally should be available in time for the review workshops.

3.3.6 Non-motorised User Audit

When available, non-motorised user audits should also be used as a valuable input to the SID process.

3.4 Responsibility of the Review Team

The role of the review team is to:

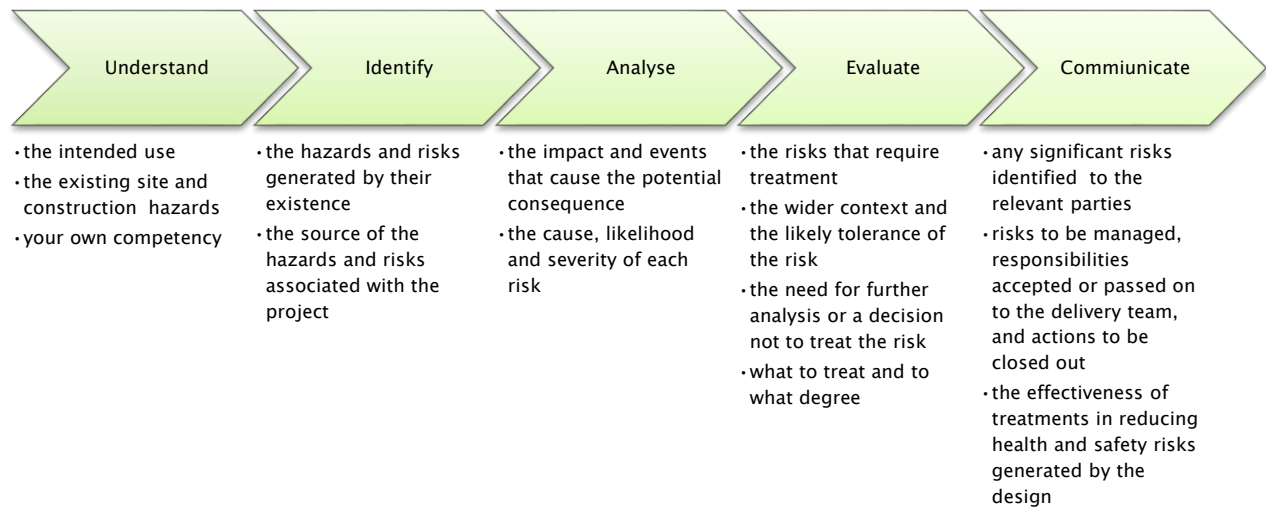


Figure 4. Responsibility of Review Team

3.4.1 General Requirements

SID reviews should be conducted in accordance with an appropriate methodology and tools for the project. ISO 31010 Risk Management provides guidance on risk assessment techniques. The methodology adopted must comply with the Z/44 minimum standard for all New Zealand Transport Agency projects. This is to ensure consistency of output and ease of incorporation of handover material.

It should be made clear at the onset of a review that the focus is on safety and ill health, not project risks. Any general project risks identified should be noted and addressed in a separate project risk workshop/meeting.

The chosen review methodology should be structured, systematic and thorough. As with any design record, the scope, purpose and the design basis upon which the review is conducted needs to be clearly documented. This is so that the state of knowledge at the time of the review is defined.

The DNZ project manager, operations and maintenance representatives, design leads and contractor representative should be invited to the review. Collaboration with the various team members will likely deliver more successful design reviews.

3.4.2 Reviews

A review should be a systematic process of establishing the context, identifying, analysing, evaluating and communicating the risks. The reviews are undertaken during the design stage in order to identify, isolate and eliminate where practical, or minimise, foreseeable risks which may occur in the construction or subsequent phases of the project life cycle.

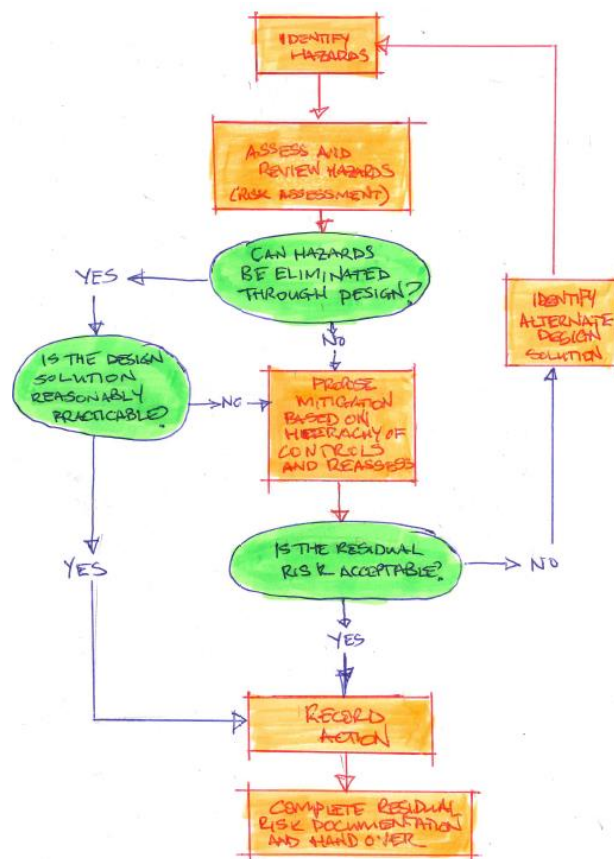


Figure 5. Systematic Process of Review

3.4.3 Facilitation

The review workshop facilitator should be an independent, suitably experienced person – they may be an employee of DNZ or the design consultant, or someone else.

3.5 Safety in Design Records and Communication

The extent of the records/report will depend on the objectives and scope of the review. The review process should be documented together with the results of the assessment. Risks should be expressed in understandable terms, and the units in which the level of risk is expressed should be clear e.g. ISO 31000, NZTA Z/44.

The results of the review, such as information on any residual risks, should be supplied with the project deliverables in an appropriate form at the end of each design phase.

In order for the project team to understand the risks that have been mitigated and/or remain to be addressed, a copy of the above information should be communicated to all team members at the end of the assessment.

The review documentation should include:

- The design documentation;
- The objectives of the review;
- The methodology employed;
- The dates, timing and participants;
- A record of all risks identified (even where no further actions or recommendations are made);
- Responsibility for specific actions and for management of the overall outcomes; and
- Identification of specific actions and residual hazards to be managed by various team members.

4 Responsibilities

DNZ project teams must integrate SID requirements into their projects. The team must also encourage collaboration to improve planning and management and the early identification of hazards. This helps the team focus their efforts on where they can have the most significant impact on H&S.

Designers have a responsibility to consult, co-operate and co-ordinate with others to ensure the safety of all those who may be affected by the asset. This includes positively influencing a project through the effective planning and management of risks. All parties must recognise the need to consider operation, maintenance, decommissioning and demolition requirements.

It is DNZ's responsibility to endorse the mitigation measures proposed by the SID process and if required, rule on what is reasonably practicable.

Chief Executive

- Is accountable for the organisation's compliance with DNZ's H&S policies and standards including allocation of resources and accountabilities across the organisation to meet this procedure.
- Ensure there are competent persons within the organisation to oversee SID.

Divisional Managers

- Are accountable for ensuring that appropriately documented processes specified in this procedure are in place across their area of responsibility.
- Ensure there are competent persons within their division to oversee SID and manage the elements of this procedure.
- Ensure all corrective actions are closed out in a timely manner.
- Communicate lessons learnt and safety alerts relevant to all incident investigations.

Group Manager – Health and Safety

- Ensure that DNZ's Health and Safety Management System (HSMS) documentation includes minimum requirements and tools to support management in meeting their responsibilities.
- Will ensure this procedure is reviewed in line with the HSMS document control procedure.

5 Other Information

- H&S Definitions (HS01-01-01).
- Full table of Procedures (HS01-01-02).
- Safety In Design Standard (HS08).
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6 Document Control

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