

# The RiggerSafe® Guidebook

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*A Practical Guide to Reducing Hand Exposure During  
Suspended Load Operations*

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*A Practical Guide to Reducing Hand Exposure During Suspended Load Operations*



PUBLISHED BY

**PSC Hand Safety India Private Limited**

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**RiggerSafe®**

A Brand of PSC Hand Safety India Private Limited  
pschandsafety.com

First Edition

# **The RiggerSafe® Guidebook**

First Edition

Published by PSC Hand Safety India Private Limited

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## FOREWORD

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# The Engineering Gap

The engineering disciplines surrounding crane operations are well established. Structural engineering determines the capacity of the crane. Rigging engineering determines the sling arrangement. Lifting engineering determines the plan.

What has received comparatively little engineering attention is the final stage of every lift — the moment when the suspended load must be guided into position. At this point, the load is still suspended, still moving, still subject to the forces that govern all suspended masses. And at this point, the worker's hands are frequently the primary interface between the load and the intended outcome.

Behaviour influences every lifting operation. Professional riggers understand the risks associated with suspended loads — their training, experience and judgement are not in question. The challenge is that, in the absence of an engineered alternative, the hand frequently becomes the only available guidance tool. Engineering should reduce the need for workers to rely on direct hand contact, not by removing professional judgement from the operation, but by providing a better interface through which that judgement can be applied safely.

The purpose of this guidebook is to close that gap.

What follows is not a collection of procedures or checklists assembled from existing regulations. It is an engineering framework developed through practical industrial experience across heavy fabrication, offshore operations, structural installation and maintenance activities — environments where suspended loads are handled routinely, professionally and under demanding conditions.

The framework rests on a straightforward principle: guidance is an engineering function, not a behavioural one. Where engineering provides the appropriate interface and the rigger understands how to apply it, hand exposure can be reduced without compromising the quality or efficiency of the lifting operation.

This guidebook does not seek to replace the professional rigger. The experienced rigger's judgement, spatial awareness and understanding of load behaviour cannot be replicated by any tool. What engineering can provide is a better interface through which that judgement is applied — one that maintains the separation between the worker and the suspended load while preserving full guidance capability.

The engineering method described in this guidebook has been tested across thousands of lifting operations in conditions ranging from confined maintenance spaces to open offshore decks. It has been refined through field observation, structural analysis and the kind of iterative improvement that only sustained industrial deployment can provide.

The result is a structured, repeatable approach to suspended load guidance that any competent lifting team can apply — regardless of industry, load type or operating environment.

Satish Agrawal

Founder

PSC Hand Safety India Private Limited

## PREFACE

# How This Guidebook Is Structured

This publication is intentionally sequenced. The sequence is not arbitrary — it reflects the order in which engineering decisions must be made before any guidance interface can be responsibly selected.

Readers first encounter the problem in engineering terms. Chapter 1 establishes why an engineering framework for suspended load guidance is necessary. Chapters 2 and 3 examine why workers approach suspended loads and how those loads behave once suspended — the physics before the engineering response.

Chapters 4 through 6 establish the engineering principles that govern hands-free suspended load guidance: what the engineering objectives are, how a professional rigger applies those principles in sequence, and what constitutes a complete guidance objective for each phase of a lift.

Chapter 7 addresses interface selection at the category level — before any specific product is introduced. The reader learns when a rigid interface is appropriate, when a flexible tension interface is more effective, and how the selection is made from engineering requirements rather than availability or habit.

Chapter 8 introduces the RiggerSafe® engineering interface — as an engineering biography rather than a product presentation. The reader who has followed the preceding chapters will recognise how each design decision reflects the engineering principles already established.

Chapters 9 through 11 address the working space, separation requirements and the way different load geometries change the engineering response — while the underlying methodology remains constant throughout.

Chapter 12 translates the complete engineering method into a practical implementation framework, including the official product specification table for procurement reference.

The purpose of this structure is to ensure that by the time a reader reaches the product specification tables in Chapter 12, they understand not only which tool to select but why. Engineering guidance cannot be reduced to a size chart. It requires understanding the load, the space and the separation before any interface is chosen.

This guidebook does not promote RiggerSafe® as the universal solution to suspended load guidance. It presents RiggerSafe® as the engineered interface that the preceding eleven chapters of engineering reasoning naturally lead to — for those tasks where a rigid engineered control interface is the appropriate engineering response.

Where taglines, alternative interfaces or different rigging arrangements are more appropriate, the guidebook says so directly.

The purpose of this publication is engineering guidance. Not product promotion.

ABOUT RIGGERSAFE®

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## About RiggerSafe®

RiggerSafe® is a suspended-load guidance brand of PSC Hand Safety India Private Limited, developed to provide professional riggers with engineered rigid control interfaces for guiding, positioning and controlling suspended loads from practical separation.

The RiggerSafe® product family and the methodology presented in this guidebook draw upon more than a decade of field observation, product development, complete-assembly testing and industrial deployment across steel, fabrication, ports, shipbuilding, offshore operations, mining, construction and heavy engineering.

RiggerSafe® builds upon the field-proven development history of PSC LoadGuider and the broader hands-free safety knowledge platform established under Hand Safety First®.

The purpose of RiggerSafe® is not to replace the professional rigger. It is to improve the interface through which professional judgement, experience and load-control skill are applied while reducing unnecessary direct body exposure to the suspended load.

RiggerSafe® is a brand of PSC Hand Safety India Private Limited.

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*Respect the craft. Improve the interface.*

HOW TO USE THIS GUIDEBOOK

Reading Guide

This guidebook can be read in sequence or used as a reference. The table below is designed to help different readers navigate directly to the content most relevant to their purpose.

| READER                                     | RECOMMENDED PATH                                                                                                                                                                                         |
|--------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Lifting engineer or HSE professional       | Read Chapters 1–6 for the engineering framework; Chapter 9 for spatial engineering; Chapter 11 for load geometry applications; Chapter 12 for the complete implementation framework.                     |
| Rigging supervisor or senior rigger        | Chapters 3, 5, 9 and 11 address load behaviour, guidance sequence, working position and geometry-specific engineering. Chapter 12 checklist is suitable for pre-task reference.                          |
| Procurement or equipment specification     | Chapter 10 for interface selection logic; Chapter 12 for the official part number specification table and engineering specification reference.                                                           |
| Safety trainer or toolbox talk facilitator | Chapters 1–3 provide accessible explanations of why hand exposure occurs. Chapter 9 provides the spatial engineering framework. Chapter 11 geometry cards are suitable for toolbox talk support.         |
| Engineer reviewing the methodology         | Read sequentially from Chapter 1. The engineering principles build progressively. Chapters 4, 6, 7 and 10 contain the core engineering arguments. Figure 12.1 summarises the complete decision sequence. |
| First-time reader                          | Begin with the Engineering Roadmap on the following page, then read Chapter 1. The sequence from Chapter 1 through Chapter 12 is designed to build engineering understanding progressively.              |

Terminology

Key engineering terms are introduced at their first use and used consistently throughout. The most important terms are:

**Movement Envelope** — the full volume of space a suspended load could reasonably occupy

**Working Position** — where the rigger stands to guide the load safely

**Required Separation** — the minimum distance between worker and suspended load

**Contact Opportunity** — a structurally suitable location for guidance force input

**Guidance Objective** — what the interface must achieve for a specific lift

**Closing Hazard** — the trapping risk as a load approaches a fixed surface

**Working Length** — the selected interface length for a specific lift

**Engineering Control Interface** — the guidance tool category

## 1–3

### CHAPTERS 1–3

#### The Problem

Why suspended load guidance is an engineering problem. Why workers reach for loads. How suspended loads behave physically.

## 4–6

### CHAPTERS 4–6

#### The Engineering Principles

Eight engineering principles for hands-free guidance. The guidance sequence from pick-up to placement. The six guidance objectives.

## 7

### CHAPTER 7

#### Interface Selection

Rigid, flexible or combined interfaces. Selection by engineering requirement, not by availability.

## 8

### CHAPTER 8

#### The Interface

The engineering biography of RiggerSafe®. Design decisions, material selection, assembly validation and the ten design principles.

## 9

### CHAPTER 9

#### Engineering the Space

Fall zones, movement envelopes, closing hazards and practical working position. The hazard space before the interface is selected.

## 10

### CHAPTER 10

#### Selecting the Appropriate RiggerSafe® Interface

Ten selection variables. The complete working length range. When taglines become the better engineering solution.

## 11

### CHAPTER 11

#### Load Geometry

Rectangular, cylindrical, long, thin, irregular, flexible, sling-supported and limited contact loads. The engineering framework applied to each.

## 12

### CHAPTER 12

#### Implementation

The complete engineering method. Product specification. Official part numbers. Implementation checklist. The RiggerSafe® Engineering Philosophy.

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## INTRODUCTION

# Engineering Begins Before the Hook Is Loaded

Every year, across thousands of lifting operations in heavy industry, shipyards, fabrication facilities, construction sites and offshore installations, workers guide suspended loads by hand. Not because they are unaware of the risk. Because no engineered alternative has been provided.

The crane is specified by a structural engineer. The slings are specified by a rigging engineer. The lifting plan is prepared by a competent person. And then — at the moment when the load is suspended, moving and approaching its final position — the guidance method is improvised.

The worker reaches out. The hand becomes the interface. The engineering stops exactly where it is most needed.

This guidebook introduces a different approach.

It argues that guidance is an engineering function — not a behavioural one. That the question is not how to warn workers away from suspended loads, but how to provide an engineered interface that allows professional guidance to be applied from an appropriate separation. That the experienced rigger's judgement should be supported by better engineering, not replaced by more instruction.

The engineering framework described in this guidebook does not depend on creating new procedures, new regulations or new professional roles. It requires only that the guidance stage of the lift receives the same engineering attention as every other stage — that the interface is selected on engineering grounds, that the working position is established before the lift begins, and that the separation between worker and load is maintained by design rather than by instruction alone.

The RiggerSafe® Engineering Method™ provides that framework. It is structured, repeatable and applicable across industrial sectors where suspended loads require guidance. It is not a product manual. It is an engineering methodology that happens to conclude with a product specification — because a methodology without an engineering solution is incomplete.

This guidebook begins with the problem. It moves through the engineering principles. It examines the working space, the load geometry and the interface selection logic in sequence. And it arrives at the product specification only after the engineering reasoning that justifies it has been fully established.

Readers who reach Chapter 12 will find not a catalogue but a consequence — the natural outcome of engineering applied systematically to a problem that has, for too long, been treated as behavioural.

### THE CENTRAL ARGUMENT OF THIS GUIDEBOOK

Hand exposure during suspended load operations deserves an engineering response. This guidebook presents a structured engineering framework for reducing that exposure while supporting the professional judgement of everyone involved in the lift.

# Chapter 1

---

## Why Hands-Off Suspended Load Guidance Requires an Engineering Framework

Establishing suspended-load guidance as a distinct engineering discipline — planned, standardised and continuously improved, like every other element of the modern lifting operation.

The worker controls the load.

The worker should not touch the load.

PRINCIPLE ONE · THE RIGGERSAFE® PHILOSOPHY

## SECTION 1.1

## Introduction

Modern industry has transformed the way heavy loads are lifted.

Advances in crane technology, engineered lifting accessories, certified rigging equipment, lifting plans, exclusion zones, operator training and risk assessment have significantly improved the safety of lifting operations across steel plants, shipyards, fabrication facilities, offshore installations, ports, power stations, construction projects, mining operations, logistics centres and heavy engineering workshops.

Today, organisations devote considerable attention to ensuring that loads are correctly calculated, lifting equipment is properly inspected, rigging arrangements are engineered, lifting accessories are certified, crane operators are competent, and lifting activities are planned before work begins. These improvements have prevented countless incidents and have established lifting operations as one of the most structured activities performed within heavy industry.

**Yet one important aspect of the lifting process has remained comparatively unchanged.**

When a suspended load approaches its final position, workers frequently guide, push, pull, align, steady, rotate or position the load using their hands. Across industries, this practice has become so familiar that it is often accepted as a normal part of the task rather than recognised as an engineering challenge.

The purpose of this guidebook is to question that assumption.

The load has travelled safely. The crane has done its job. The rigging has performed correctly. Yet the final adjustment is frequently completed by placing a hand directly onto the load.

### CHAPTER AT A GLANCE

1. Introduction — the unchanged final metres of the lift
2. The missing discipline in lifting guidance
3. A different way of thinking — method, not only behaviour
4. The purpose of the RiggerSafe® Guidebook
5. The RiggerSafe® Philosophy — five principles
6. Objectives of this guidebook
7. Intended users
8. Looking forward

### SECTORS WITHIN SCOPE

Steel plants · shipyards · fabrication facilities · offshore installations · ports · power stations · construction projects · mining operations · logistics centres · heavy engineering workshops.

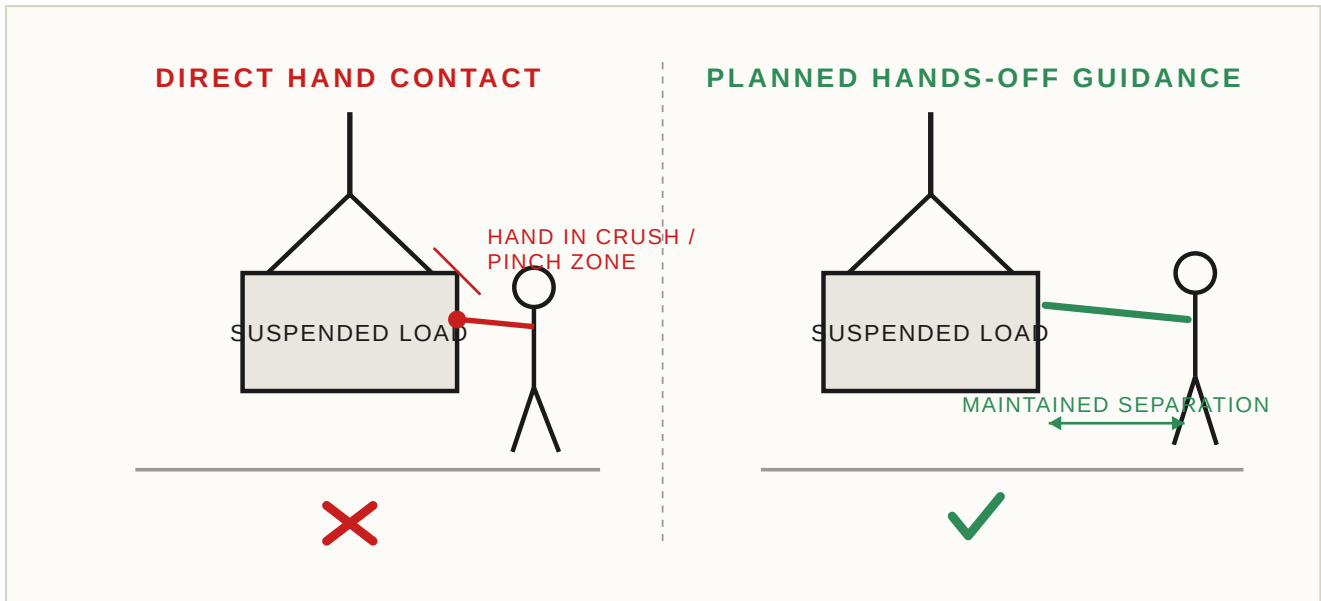


**FIGURE 1.1** — Final positioning of a suspended load: direct hand contact (left) versus planned hands-off guidance maintaining separation and physical control (right).

## SECTION 1.2

### The Missing Discipline

Industry has developed comprehensive standards governing how loads should be lifted.

International and company-specific procedures address lifting equipment, rigging arrangements, crane operation, inspection, signalling, exclusion zones, lifting accessories, planning, supervision, competency and risk management. However, comparatively little guidance exists regarding how suspended loads should be safely guided during the final stages of positioning.

WHAT WORKERS ARE COMMONLY INSTRUCTED

- Keep hands clear.
- Stay out of the line of fire.
- Avoid pinch points.
- Never place hands beneath suspended loads.

These instructions are correct. They are also incomplete. They describe what workers should avoid, but they do not always explain how the work should be completed when guidance, alignment or positioning is still required. As a result, many lifting operations continue to depend upon manual intervention during the final moments of the task.

TABLE 1.1 — THE INSTRUCTION GAP IN SUSPENDED-LOAD GUIDANCE

| WHAT EXISTING GUIDANCE<br>ESTABLISHES      | WHAT REMAINS UNANSWERED                                          |
|--------------------------------------------|------------------------------------------------------------------|
| Keep hands clear of the load.              | How is the load rotated, steadied or aligned without hands?      |
| Stay out of the line of fire.              | From what position, and with what method, is control maintained? |
| Avoid pinch points.                        | How is final alignment over pins, flanges or seatings achieved?  |
| Never place hands beneath suspended loads. | What planned work method replaces the improvised hand?           |

The load has travelled safely. The crane has done its job. The rigging has performed correctly. Yet the final adjustment — the movement of a few millimetres or a few centimetres — is frequently completed by placing a hand directly onto the load.

This guidebook recognises suspended-load guidance as a distinct engineering discipline deserving the same structured approach that industry already applies to lifting operations themselves.

ENGINEERING NOTE

The absence of a defined guidance method is itself a hazard condition. Where a procedure specifies the lift but not the positioning, the positioning method defaults to the worker's hands.

SECTION 1.3

## A Different Way of Thinking

For many years, discussions surrounding hand injuries during lifting operations have focused primarily on worker behaviour.

Workers are reminded to be careful. They are instructed to keep their hands clear. Additional training is delivered, toolbox talks are conducted, and posters reinforce safe behaviours. These initiatives remain important.

**However, this guidebook begins from a different premise.** Workers rarely place their hands on suspended loads because they intend to take unnecessary risks. More often, they do so because the task itself still depends upon direct hand contact.

WHERE THE TASK STILL DEMANDS THE HAND

- A load must be rotated.
- A pipe spool must align with a flange.
- A gearbox must settle over locating pins.
- A steel plate requires final positioning.
- A structural member needs a slight correction.

**When no practical alternative exists, the worker's hand becomes part of the guidance system.**

From an engineering perspective, this represents a work-method challenge rather than simply a behavioural challenge.

TABLE 1.2 — REFRAMING THE CHALLENGE

| BEHAVIOURAL FRAMING                                      | WORK-METHOD FRAMING                                                     |
|----------------------------------------------------------|-------------------------------------------------------------------------|
| The worker chose to touch the load.                      | The task offered no engineered alternative to touching the load.        |
| Corrective action: reminders, retraining, reinforcement. | Corrective action: redesign the guidance method before the lift begins. |
| Responsibility rests at the point of exposure.           | Responsibility is engineered out during planning.                       |
| Improvement depends on continuous vigilance.             | Improvement is repeatable across crews, shifts and sites.               |

Improving behaviour remains important. Improving the method is equally important.

SECTION 1.4

# The Purpose of the RiggerSafe® Guidebook

The RiggerSafe® Guidebook has been developed to establish engineering principles for hands-off suspended load guidance.

Its purpose is not to replace recognised lifting standards, company procedures or statutory requirements. Instead, it complements existing lifting practices by addressing a specific aspect of lifting operations that has historically received comparatively little engineering attention — the safe guidance and positioning of suspended and moving loads.

The standard promotes the systematic reduction of direct hand exposure during guidance activities by encouraging planned work methods that maintain physical control while increasing separation between the worker and the hazard.

Rather than viewing guidance as an improvised action performed during the final moments of a lift, this guidebook encourages organisations to recognise guidance as an activity that should be **engineered, planned, assessed and standardised before the lift begins.**

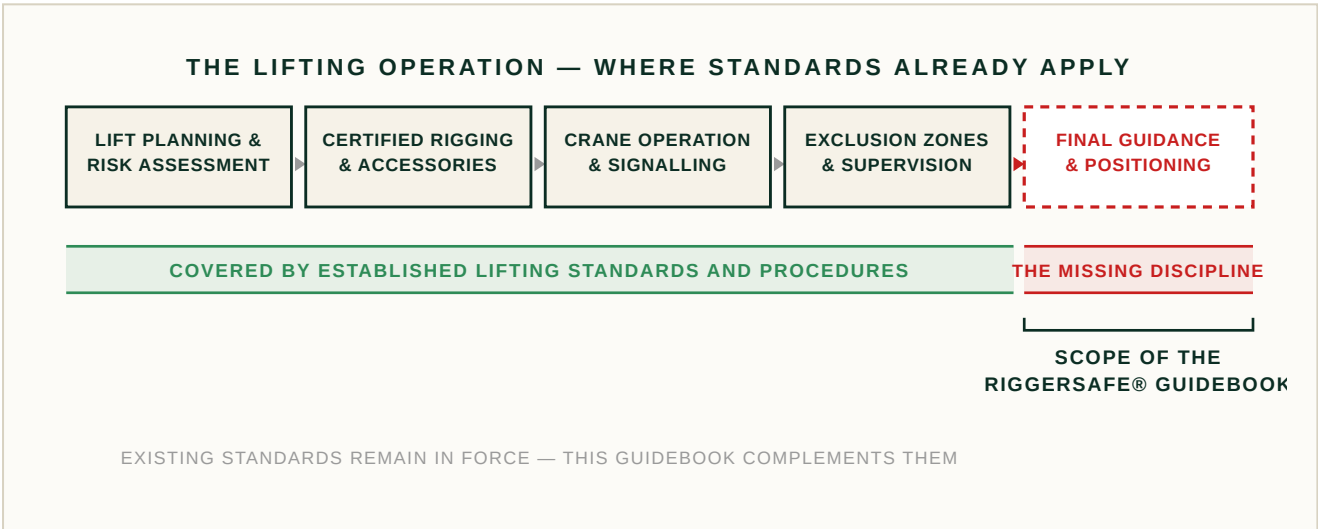


**FIGURE 1.2** — Position of the RiggerSafe® Guidebook within the lifting operation: it addresses final guidance and positioning, complementing established lifting standards.

## SECTION 1.5

## The RiggerSafe® Philosophy

The RiggerSafe® Guidebook is founded upon five guiding principles. Together they define the engineering posture of the standard: physical control of the load is retained; direct contact with the load is not.

**1****The worker controls the load. The worker should not touch the load.**

Control and contact are separated. Guidance is exercised through a planned method, not through the hand.

**2****Distance is a safety control.**

Maintaining greater separation from a suspended or moving load is itself an engineering control that reduces the likelihood of hand exposure to crush, pinch, impact and line-of-fire hazards.

**3****The guidance method should be planned before the lift begins.**

Workers should never be left to improvise methods of guidance during the critical stages of positioning.

**4****Final positioning deserves the same engineering attention as lifting.**

The final stages of positioning frequently require the greatest precision while simultaneously presenting some of the greatest opportunities for direct hand exposure.

**5****Hands-off suspended load guidance should become standard practice.**

Safe guidance should be achieved through planned engineering methods that can be repeated consistently across crews, departments and sites.

**APPLICATION NOTE**

These five principles are referenced throughout The RiggerSafe® Guidebook. Subsequent chapters develop each principle into assessable requirements, planned work methods and acceptance criteria for lifting teams.

SECTION 1.6

# Objectives of This Guidebook

This guidebook seeks to assist organisations in:

- Reducing direct hand exposure during suspended-load guidance.
- Promoting planned hands-off guidance methods.
- Supporting greater stand-off distances during positioning activities.
- Encouraging engineering controls before reliance on administrative controls alone.
- Standardising suspended-load guidance practices across lifting operations.
- Providing a common engineering language for suspended-load guidance.

SECTION 1.7

# Intended Users

The RiggerSafe® Guidebook has been prepared for professionals responsible for the planning, execution, supervision and improvement of lifting operations, including:

|                             |                                 |
|-----------------------------|---------------------------------|
| Lifting Engineers           | Rigging Supervisors             |
| Crane & Lifting Authorities | HSE Professionals               |
| Maintenance Engineers       | Operations Managers             |
| Reliability Engineers       | Project Engineers               |
| Procurement Teams           | Training & Competency Personnel |

It is equally applicable to owner organisations, engineering contractors, EPC companies, maintenance service providers, offshore operators and industrial facilities seeking to reduce hand exposure during suspended-load activities.

SECTION 1.8

Looking Forward

The purpose of this publication extends beyond introducing a guidance tool.

Its broader objective is to encourage industry to recognise hands-off suspended load guidance as an engineering discipline that deserves planning, standardisation and continuous improvement. Just as lifting plans, exclusion zones and certified rigging have become accepted elements of modern lifting practice, hands-off guidance should become an equally recognised component of safe load positioning.

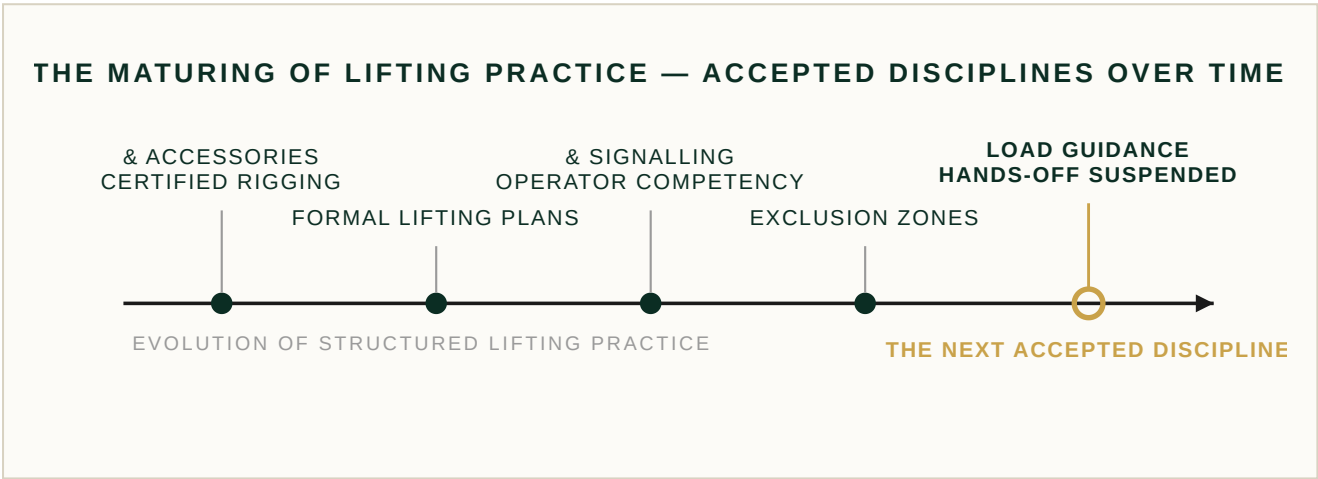


**FIGURE 1.3** — Structured lifting practice has matured discipline by discipline. This guidebook positions hands-off guidance as the next accepted element of safe load positioning.

The ultimate objective of the RiggerSafe® Guidebook is not simply to change equipment. It is to change the way industry thinks about guiding suspended loads.

CHAPTER 1

Summary of Key Positions

TABLE 1.3 — CHAPTER 1 IN BRIEF

| POSITION            | STATEMENT                                                                                                                                                                                                                                       |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The gap             | Lifting has been transformed by engineering; final guidance and positioning of suspended loads has remained comparatively unchanged and frequently depends on direct hand contact.                                                              |
| The instruction gap | Existing instructions correctly state what to avoid, but do not always define how guidance, alignment and positioning should be completed.                                                                                                      |
| The reframe         | Hand contact with suspended loads is primarily a work-method challenge, not solely a behavioural one. Improving behaviour remains important; improving the method is equally important.                                                         |
| The standard        | The RiggerSafe® Guidebook complements existing lifting standards by establishing engineering principles for hands-off suspended load guidance — planned, assessed and standardised before the lift begins.                                      |
| The philosophy      | Five principles: the worker controls but does not touch the load; distance is a safety control; the guidance method is planned before the lift; final positioning deserves engineering attention; hands-off guidance becomes standard practice. |
| The direction       | Hands-off guidance should become as accepted as lifting plans, exclusion zones and certified rigging — a recognised component of safe load positioning.                                                                                         |

CONTINUED IN THE RIGGERSAFE® GUIDEBOOK

Subsequent chapters develop the principles introduced here into assessable requirements, planned guidance methods, task assessment criteria and implementation guidance for lifting teams and organisations.

GENERAL NOTES

This guidebook complements — and does not replace — recognised lifting standards, company procedures and statutory requirements. Application should be assessed against site-specific conditions, task risk assessments and the requirements of the controlling lifting authority.

IMPRINT

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# Chapter 2

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## Why Workers Reach for Suspended Loads

*Understanding Human Behaviour Before Engineering the Solution*

Workers do not reach for suspended loads because they disregard safety procedures. They do so because a lifetime of experience has taught them that touching an object is the most effective way to control it. This chapter examines that instinct — and what it means for the engineering of safer guidance methods.

The challenge is not to change human nature.

The challenge is to design work methods that recognise it.

CHAPTER 2 SUMMARY PRINCIPLE

## CHAPTER OVERVIEW

# The Moment Every Worker Knows

Every worker who has guided a suspended load has faced the same moment.

The load is almost in position. It needs only a slight adjustment — a few millimetres to the left, a slight rotation, a correction to stop it swinging. Without conscious thought, the worker reaches out.

This action is so common that it is rarely questioned. Yet it represents one of the most important moments in the entire lifting operation.

Understanding why workers instinctively reach for suspended loads is essential to understanding why hand injuries continue to occur despite training, procedures and repeated safety reminders. This chapter examines the behavioural and engineering factors that make direct hand contact feel natural, why this instinct persists throughout working life, and why effective engineering controls must work with human behaviour rather than simply attempting to suppress it.

## CHAPTER AT A GLANCE

1. Human behaviour is learned through touch
2. The Everyday Experience Gap
3. Why the last movement is different
4. Guidance versus control
5. Why workers reach for loads
6. The final correction
7. Engineering implications
8. Chapter summary

## SECTION 2.1

# Human Behaviour Is Learned Through Touch

Human beings learn to interact with the physical world through direct contact.

From infancy, almost every task involving movement, balance, positioning or correction is performed using the hands. A child learning to walk instinctively reaches for furniture to maintain balance. A falling object is automatically caught. A chair is steadied before it tips. A box is pushed into position with the palm of the hand.

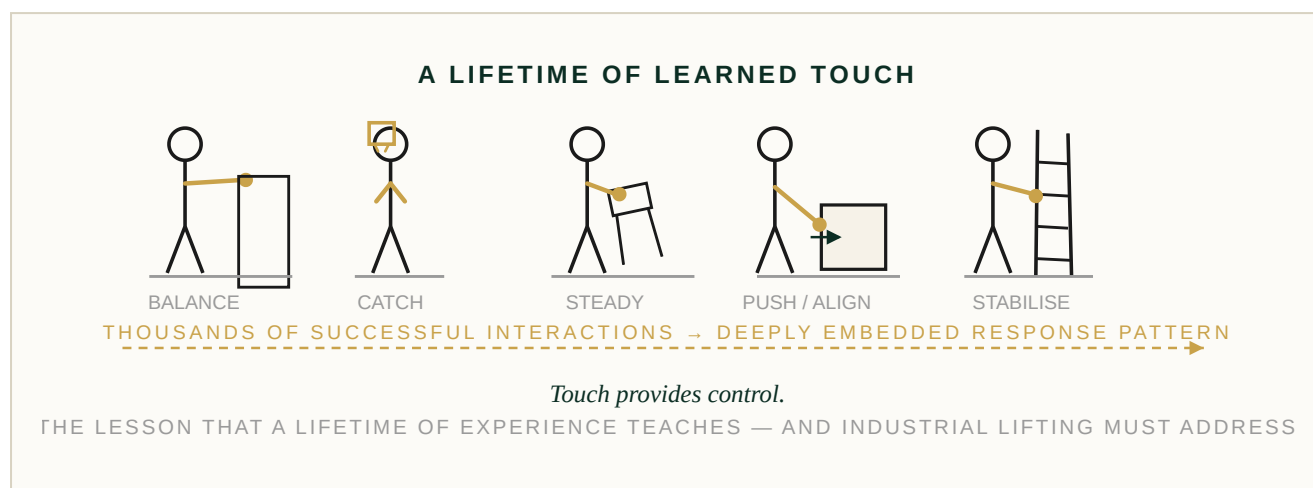


**FIGURE 2.1** — A lifetime of successful touch-based interactions establishes hand contact as the brain's default control strategy. Each experience reinforces the pattern: reach, touch, correct.

Thousands of similar interactions accumulate throughout childhood and adulthood. Each successful experience reinforces the same lesson: touch provides control. Over time this becomes one of the most deeply embedded movement patterns in the human brain. It is efficient. It works. It rarely fails in everyday activities. By adulthood, the response is effectively automatic — when an object moves unexpectedly, the immediate reaction is to reach out and control it.

This behaviour is neither irrational nor careless. It is the product of a lifetime of successful learning.

SECTION 2.2

# The Everyday Experience Gap

The problem is not the worker. The problem is that industrial lifting environments operate under conditions that differ fundamentally from everyday experience.

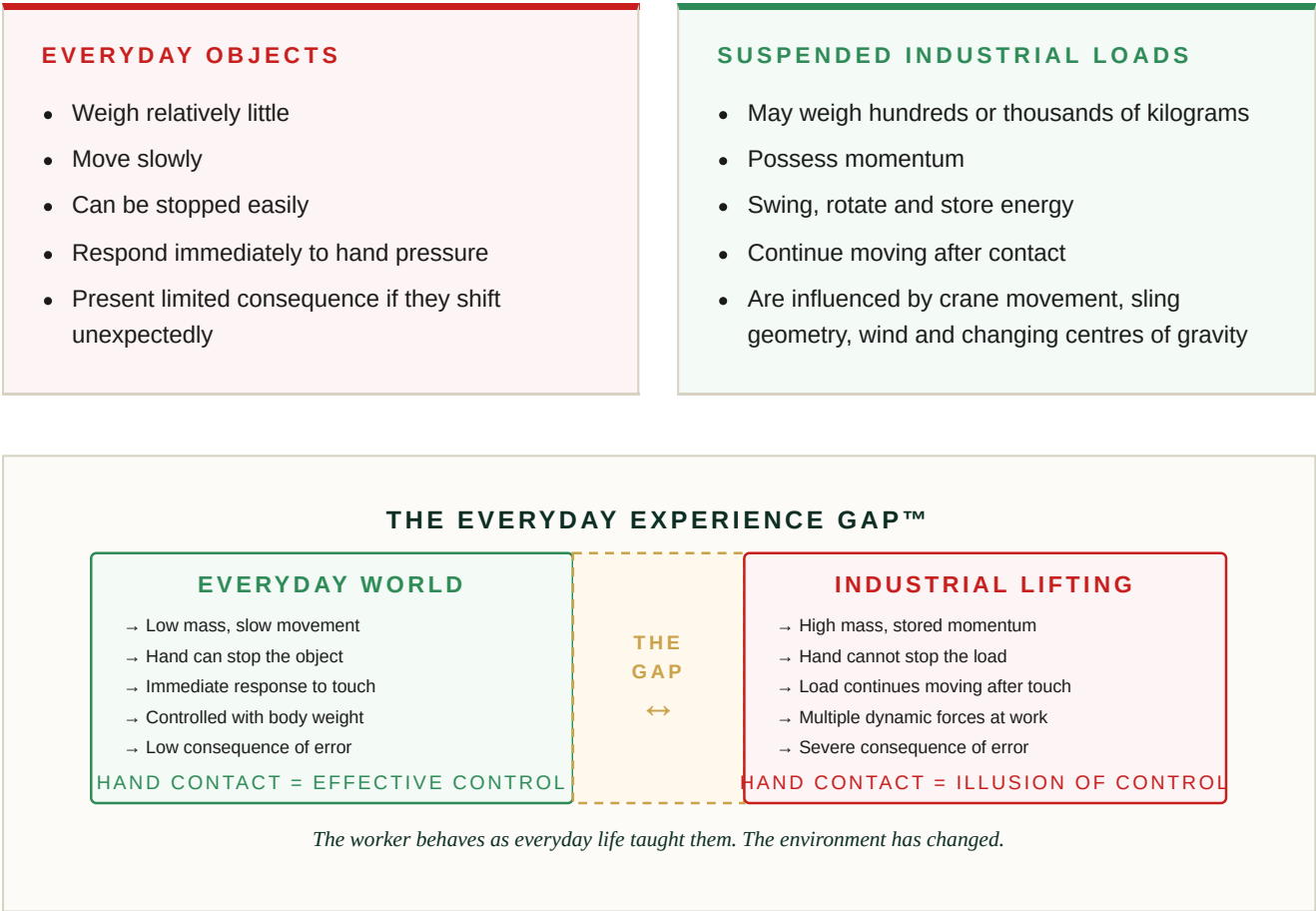


**FIGURE 2.2** — The Everyday Experience Gap: strategies that successfully control everyday objects can expose workers to significant hazards when applied to suspended industrial loads.

This creates what may be described as the **Everyday Experience Gap** — workers naturally apply movement strategies learned in everyday life to environments in which the physical behaviour of the load is fundamentally different. The worker is not behaving irrationally. The worker is behaving exactly as everyday life has taught them to behave. The environment has changed.

## SECTION 2.3

## Why the Last Movement Is Different

The majority of a lifting operation often proceeds without direct hand contact.

The crane lifts the load. The operator transports it safely. Communication is maintained. Exclusion zones remain effective. It is only as the load approaches its final position that the task fundamentally changes.

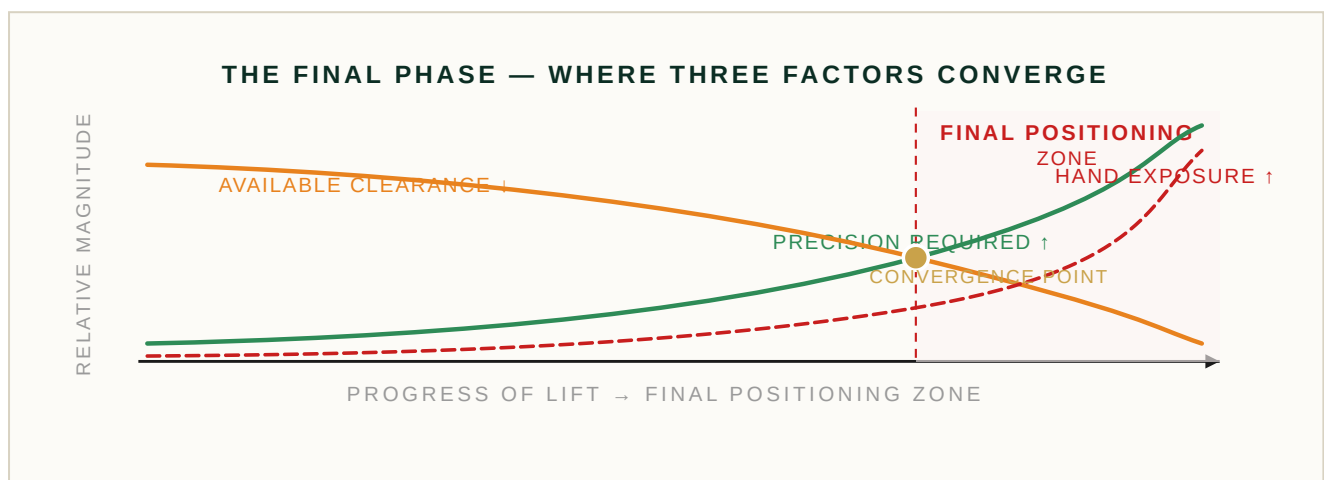


**FIGURE 2.3** — During the final positioning phase, precision requirements rise, available clearances narrow and hand exposure increases simultaneously. This convergence makes the final movement the highest-risk stage of the lift.

As precision requirements increase, workers naturally move closer to the load — because closeness has always been associated with improved control. Ironically, this is precisely the point at which exposure also increases.

### CRITICAL OBSERVATION

The final movement frequently requires the greatest precision while offering the smallest margin for error. Greater proximity and greater hazard coincide at exactly the same moment.

The load must now be aligned rather than transported. It may need to rotate slightly, move sideways, seat correctly, avoid adjacent equipment, or fit between existing structures. None of these requirements is served by a hand that cannot stop what it is touching.

SECTION 2.4

Guidance Versus Control

One of the most common misconceptions during lifting operations is that touching the load improves control. In reality, direct hand contact often provides only the *perception* of control.

The actual movement of a suspended load continues to be governed by the crane, the lifting equipment, the rigging arrangement, the centre of gravity, inertia, momentum and external influences. The worker is influencing the load — not controlling it.

DISTINCTION OF PRINCIPLE

**Guidance** should support controlled positioning. It should never depend upon the worker's hand becoming part of the lifting system.

Recognising this distinction — between the perception of control and actual control — is fundamental to the engineering approach of this guidebook.

SECTION 2.5

Why Workers Reach for Loads

Workers typically reach for suspended loads for practical, task-driven reasons — not from disregard for safety.

TABLE 2.1 — COMMON REASONS WORKERS REACH FOR SUSPENDED LOADS

| REASON                                | ENGINEERING INTERPRETATION                                                      |
|---------------------------------------|---------------------------------------------------------------------------------|
| Stop rotation                         | No planned rotational control method was established before the lift began.     |
| Correct alignment                     | The guidance method did not account for the final alignment tolerance required. |
| Improve positioning accuracy          | Stand-off guidance was not provided; precision defaulted to hand contact.       |
| Prevent contact with nearby equipment | Spatial constraints were not assessed as part of the guidance plan.             |
| Reduce swing                          | No tagline or damping method was specified for this stage of the lift.          |
| Assist installation                   | The final seating sequence was not engineered to reduce hand exposure.          |
| Speed up task completion              | The guidance method, if one existed, was slower than improvised hand contact.   |

ENGINEERING NOTE

In many workplaces, these actions have become normalised because they have been performed successfully thousands of times without incident. Repeated success reinforces the belief that the behaviour is safe — even though the consequence of a single unexpected load movement can be severe.

## SECTION 2.6

## The Final Correction

Many hand injuries do not occur because the lift failed. They occur because the lift almost succeeded.

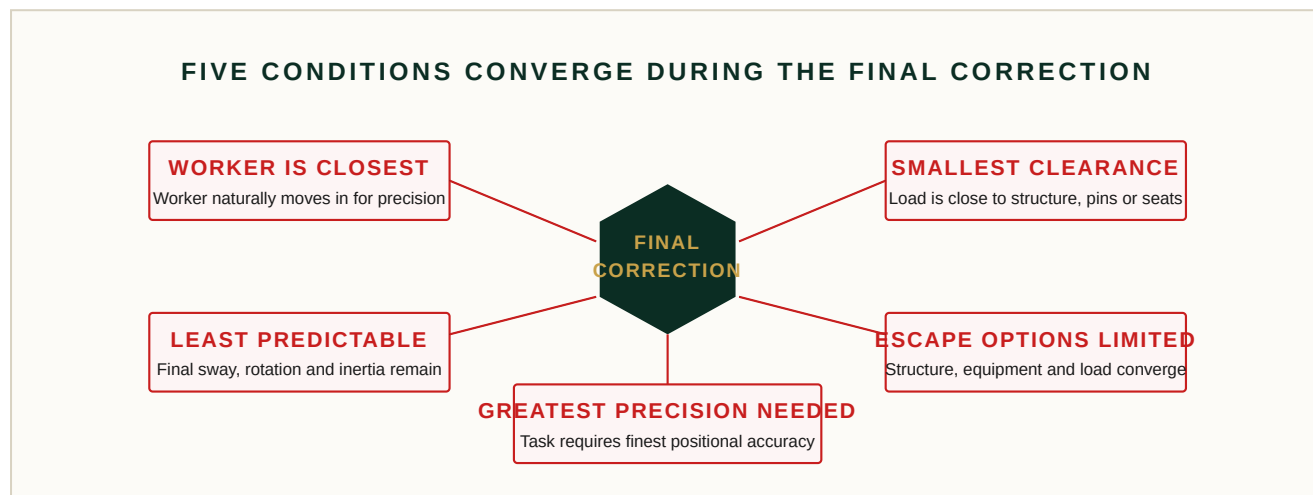


**FIGURE 2.4** — Five adverse conditions converge during the final correction: the worker is closest, clearances are smallest, movement is least predictable, escape options are most limited, and greatest precision is required.

The final correction often appears insignificant. Yet it is precisely at this stage that clearances are smallest, movement becomes least predictable and escape options become most limited. For this reason, the final correction deserves the same level of engineering planning as every other stage of the lift.

The objective should not be to eliminate necessary guidance. The objective should be to eliminate unnecessary hand exposure during guidance.

SECTION 2.7

Engineering Implications

Understanding why workers reach for suspended loads changes the engineering approach to prevention.

If direct hand contact results primarily from the way work is performed rather than from deliberate risk-taking, then improving safety requires improving the work method.

TABLE 2.2 — FROM BEHAVIOURAL TO ENGINEERING RESPONSE

| BEHAVIOURAL RESPONSE                               | ENGINEERING RESPONSE                                                             |
|----------------------------------------------------|----------------------------------------------------------------------------------|
| Remind workers not to touch the load.              | Provide a practical, planned method that does not require touching the load.     |
| Add warnings and signage at the point of exposure. | Engineer the point of exposure out of the task.                                  |
| Retrain after each incident.                       | Assess guidance method before the lift; build the control into the lifting plan. |
| Rely on worker discipline and vigilance.           | Design the guidance method to support natural behaviour, not work against it.    |
| Accept improvisation during final positioning.     | Standardise the guidance method so it can be repeated across crews and sites.    |

Engineering controls should therefore provide practical alternatives to direct hand contact, maintain control while increasing stand-off distance, integrate naturally into the lift plan, and support the working practices that come most readily to the people performing the task.

ENGINEERING CONTROLS — REQUIREMENTS

- Provide a practical alternative to direct hand contact.
- Maintain guidance capability while increasing stand-off distance.
- Integrate into lift planning rather than require separate procedures.
- Support natural working practices rather than relying solely on behavioural reminders.
- Become part of standard operating procedures so they are repeated consistently.

When engineering methods acknowledge how people naturally behave, safer behaviours become easier to perform consistently.

SECTION 2.8

Chapter Summary

Workers do not instinctively reach for suspended loads because they disregard safety procedures.

They do so because a lifetime of successful experience has taught them that touching an object is the most effective way to control it. Industrial lifting changes that relationship. Suspended loads behave differently from everyday objects — they possess mass, momentum, stored energy and movement characteristics that cannot be safely managed through direct hand contact alone.

Recognising this difference is the first step towards developing engineering methods that maintain operational control while reducing hand exposure.

The challenge is not to change human nature. The challenge is to design work methods that recognise it.

TABLE 2.3 — CHAPTER 2 IN BRIEF

| CONCEPT                     | KEY POSITION                                                                                                                                                                                           |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Touch as control            | Human beings learn through a lifetime of direct contact that touching provides control. This is a rational and deeply embedded response — not a behavioural failure.                                   |
| The Everyday Experience Gap | Movement strategies effective for everyday objects are not appropriate for suspended industrial loads, which possess mass, momentum and energy that cannot be stopped by hand.                         |
| The final movement          | Precision requirements are highest, clearances smallest, movement least predictable and escape options most limited precisely when the worker moves closest to the load.                               |
| Guidance vs control         | Direct hand contact provides the perception of control. The load continues to be governed by crane, rigging and physics. Guidance and control are not the same thing.                                  |
| Why workers reach           | Practical, task-driven reasons — stopping rotation, correcting alignment, speeding up positioning. Normalised by repeated successful experience without incident.                                      |
| The engineering response    | If hand contact results from the work method, the work method must be improved. Engineering controls that work with natural behaviour produce more consistent results than those that work against it. |

CONTINUED IN THE RIGGERSAFE® GUIDEBOOK

Chapter 3 introduces the engineering framework for hands-off suspended load guidance — building from the behavioural foundations established in this chapter to planned guidance methods and assessable engineering requirements.

PUBLICATION DETAILS

Chapter 2 — Publication Record

TABLE 2.4 — FIGURES AND TABLES INDEX

| REFERENCE  | TITLE                                                                | PAGE |
|------------|----------------------------------------------------------------------|------|
| Figure 2.1 | A Lifetime of Learned Touch — five everyday interaction patterns     | 03   |
| Figure 2.2 | The Everyday Experience Gap™ — everyday vs industrial load behaviour | 04   |
| Figure 2.3 | The Final Phase — precision, clearance and hand exposure convergence | 05   |
| Figure 2.4 | Five Conditions That Converge During the Final Correction            | 07   |
| Table 2.1  | Common reasons workers reach for suspended loads                     | 06   |
| Table 2.2  | From behavioural to engineering response                             | 08   |
| Table 2.3  | Chapter 2 in brief                                                   | 09   |

TERMINOLOGY USED IN THIS CHAPTER

**Everyday Experience Gap** — The mismatch between movement strategies that successfully control everyday objects and the physical behaviour of suspended industrial loads.

**Final Correction** — The last positional adjustment made to a suspended load before it is seated, lowered or installed.

**Guidance versus Control** — Guidance influences the direction or position of a suspended load; control determines its movement. Direct hand contact provides guidance, not control. Control remains with the crane and rigging system.

GENERAL NOTES

This chapter complements — and does not replace — recognised lifting standards, company procedures and statutory requirements.

Application should be assessed against site-specific conditions, task risk assessments and the requirements of the controlling lifting authority.

# Chapter 3

---

## How Suspended Loads Behave

A suspended load does not behave like an object resting on the floor, a bench or a pallet. Once clear of its support it is free to swing, drift, tilt, rotate and continue moving after the crane has stopped. Understanding that movement is the prerequisite for planning how the load should be guided.

Plan how the load will be guided  
before it leaves its support,  
not when it reaches the landing area.

CHAPTER 3 PRACTICAL CONCLUSION

## CHAPTER OVERVIEW

## Understanding the Load Before Guiding It

A suspended load does not behave like an object resting on the floor, a bench or a pallet.

Once lifted clear of its support, a load is free to swing, drift, tilt, rotate and continue moving after the crane has stopped. Its behaviour is influenced not only by weight and shape, but also by how it is connected, how it is lifted, how smoothly it is moved and what is happening around it.

People working near suspended loads do not need to become rigging designers. They do, however, need enough understanding to recognise why a load may move differently from what they expect.

This chapter explains the behaviour of suspended loads in routine industrial lifting — covering everyday tasks such as moving machinery, plates, pipes, skids, fabricated frames, crates and maintenance components. The purpose is direct: **understand the movement before deciding how the load should be guided.**

## CHAPTER AT A GLANCE

1. What changes when the load leaves its support
2. The whole lifting setup influences behaviour
3. How the load leaves its support
4. Balance point, hook position and lifting points
5. Sling arrangement and sling type
6. Swing, drift and rotation
7. Moving to the landing area
8. Final placement in a designated area
9. Precision positioning as a special case
10. When the hand becomes the control interface
11. What this means for everyday lifting

## SECTION 3.1

## What Changes When the Load Leaves Its Support

Before lifting, a load is normally supported by the floor, a pallet, a vehicle, dunnage or another fixed surface. That surface restricts movement. A motor resting on the floor cannot swing freely. A steel plate on dunnage cannot rotate without overcoming friction.

**Once the load is lifted, those restrictions disappear.** The load hangs from the hook through slings or other lifting attachments and is free to move — forwards and backwards, sideways, around the hook, around its own balance point, and towards or away from nearby structures. Several movements may combine simultaneously.

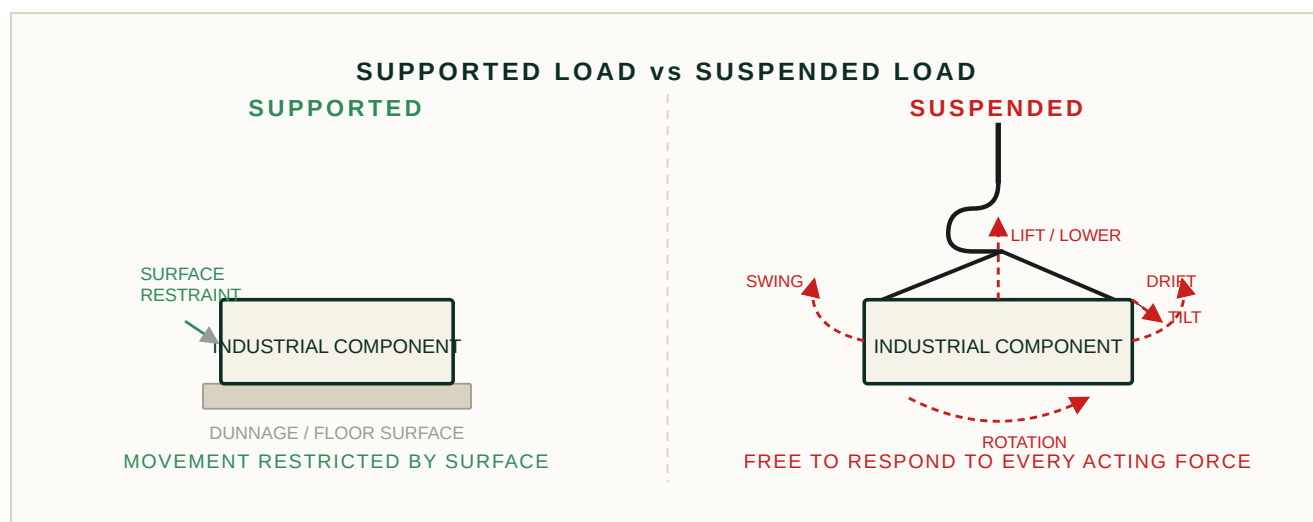


**FIGURE 3.1** — The same component in two states: supported (left), where surface contact restricts movement; and suspended (right), where all restraint is removed and the load is free to swing, drift, rotate, tilt and travel vertically.

#### ENGINEERING NOTE

A supported load is restrained by the surface beneath it. A suspended load is free to respond to every force acting on it. This distinction is the foundation of all suspended-load guidance planning.

## SECTION 3.2

### The Whole Lifting Setup Influences Behaviour

The behaviour of a suspended load is not controlled by one factor alone. It is the result of the complete lifting setup. Understanding which factors are involved is the first step in predicting how the load may move.

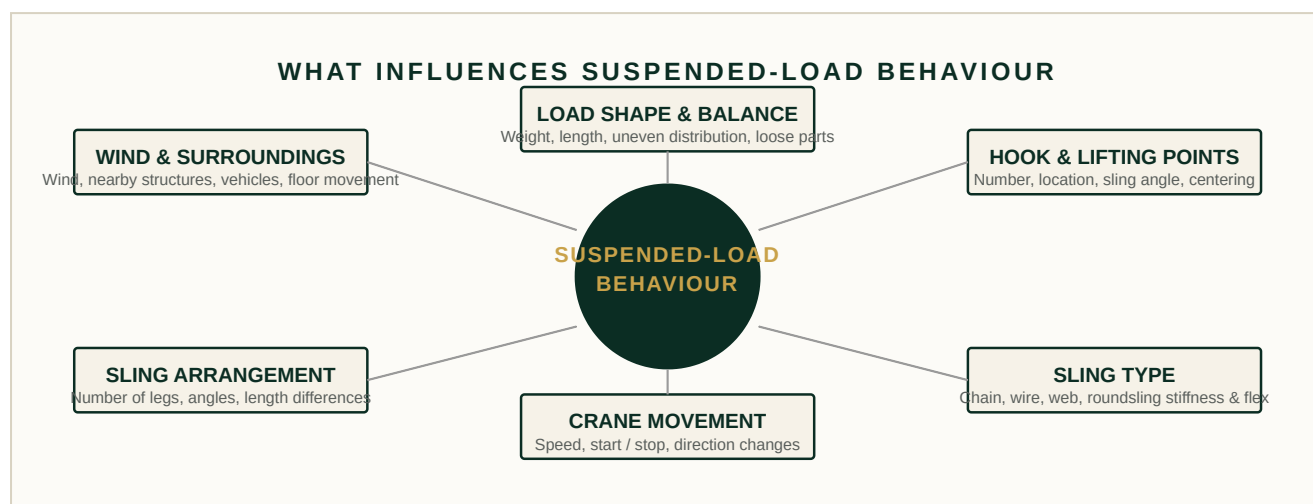


**FIGURE 3.2** — Suspended-load behaviour belongs to the complete lifting system. All six factors contribute; changing any one of them may change how the load behaves.

### SECTION 3.3

## How the Load Leaves Its Support

The first moments of a lift are important. If the load is lifted suddenly or unevenly, movement may be introduced from the start — and that movement can persist through the entire travel phase. One sling leg may tighten before the others, one side may rise first, stored twist in the slings may start rotation, or a sudden lift may introduce swing that takes time to decay.

#### THE TEST LIFT

A careful initial lift — raising the load a short distance and pausing — allows the team to confirm that the load is balanced, that slings have taken weight correctly, that no part is caught, and that unexpected tilt or rotation is not developing before travel begins.

**Key position:** A load lifted smoothly has a better chance of beginning its journey in a stable condition. A load that is snatched from the ground may carry swing or rotation into the travel phase.

## SECTION 3.4

## The Balance Point, Hook Position and Lifting Points

Every load has a point around which its weight is balanced — what engineers call the **centre of gravity**. When suspended, the load tries to settle so this balance point sits beneath the effective point from which it is hanging. If the hook is not positioned correctly in relation to the balance point, the load may tilt, move sideways, rotate, lift one end first or settle at an angle.

### PLAIN-LANGUAGE DEFINITIONS

**Centre of gravity** — the point around which the load's weight is balanced. When suspended, the load will move until this point sits directly beneath the hook.

**Lifting point (pick point)** — the place where a sling or lifting attachment connects to the load. The position of lifting points relative to the centre of gravity determines how level the load hangs.

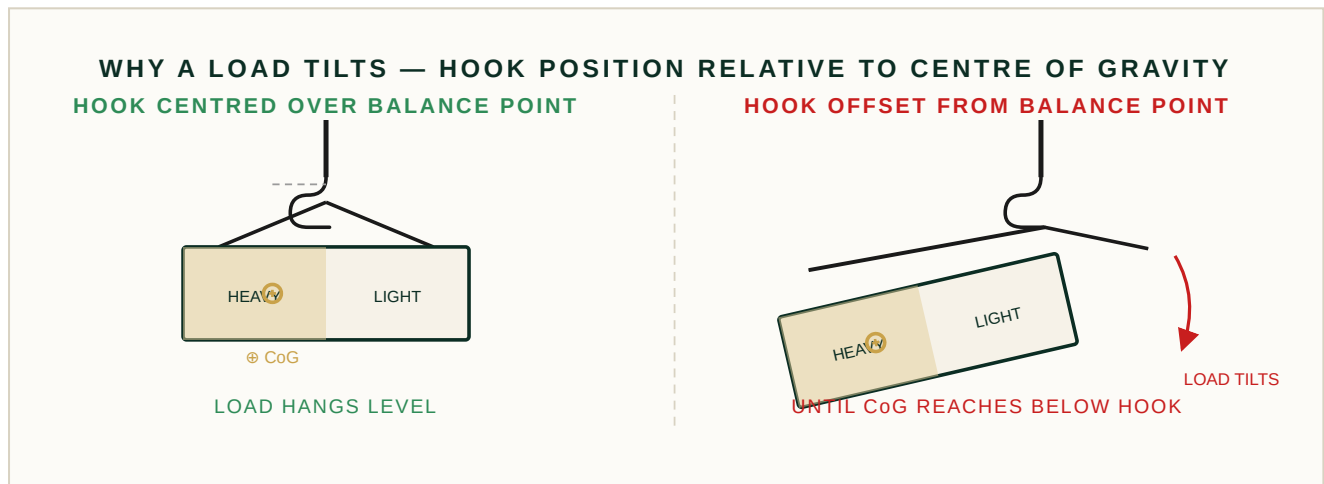


**FIGURE 3.3** — When the hook is centred over the load's balance point (left), the load hangs level. When the hook is offset from the balance point (right), the load tilts until its centre of gravity repositions beneath the hook.

The load is not becoming unstable without reason. It is seeking its natural hanging position. This is why experienced lifting teams pay close attention to hook position, sling connection locations, and which side of the load is heavier — particularly during the initial lift.

SECTION 3.5

Sling Arrangement and Sling Type

The sling arrangement influences how the load takes weight and how stable it feels once suspended. This chapter does not teach sling design or load calculations — those decisions remain with competent lifting personnel. However, workers should understand that **changing the sling arrangement may change load behaviour**.

TABLE 3.1 — SLING ARRANGEMENT: EFFECTS ON LOAD BEHAVIOUR

| ARRANGEMENT | HOW IT WORKS                                    | BEHAVIOUR CONSIDERATION                                                                                                                                                 |
|-------------|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Two-leg     | Supports the load from two main lifting points. | If one side is heavier, one leg takes more load and the item may tilt or rotate while settling.                                                                         |
| Four-leg    | Provides support over more lifting points.      | Four legs do not automatically share load equally. Small differences in lifting-point height, sling length or sling angle may cause some legs to tighten before others. |

**The important lesson is not that one arrangement is always better.** The number of sling legs, their position and how evenly they take weight all influence how the load lifts and settles.

TABLE 3.2 — SLING TYPE: BEHAVIOURAL CHARACTERISTICS

| SLING TYPE       | KEY BEHAVIOURAL CHARACTERISTIC                                                  |
|------------------|---------------------------------------------------------------------------------|
| Chain slings     | Linked sections move at each joint; limited stretch; predictable under load.    |
| Wire rope slings | Own stiffness from rope construction; may retain twist if not managed.          |
| Flat web slings  | Flexible; conform closely around the load; may allow settling or edge movement. |
| Roundslings      | Can settle or shift inside protective cover; very flexible and load-conforming. |

These differences influence how slack is removed, how the load settles, whether the sling twists, how evenly the legs share the load and how much movement occurs during the initial lift. The sling type is therefore part of load behaviour, not only a question of lifting capacity.

ENGINEERING NOTE

This guidebook does not replace rigging procedures or sling-selection rules. Its purpose is to help non-specialist readers understand why two apparently similar lifts may behave differently — and why that difference matters at the guidance stage.

SECTION 3.6

Swing, Drift and Rotation

Suspended loads commonly exhibit three visible types of movement. Each can occur alone or in combination with the others.

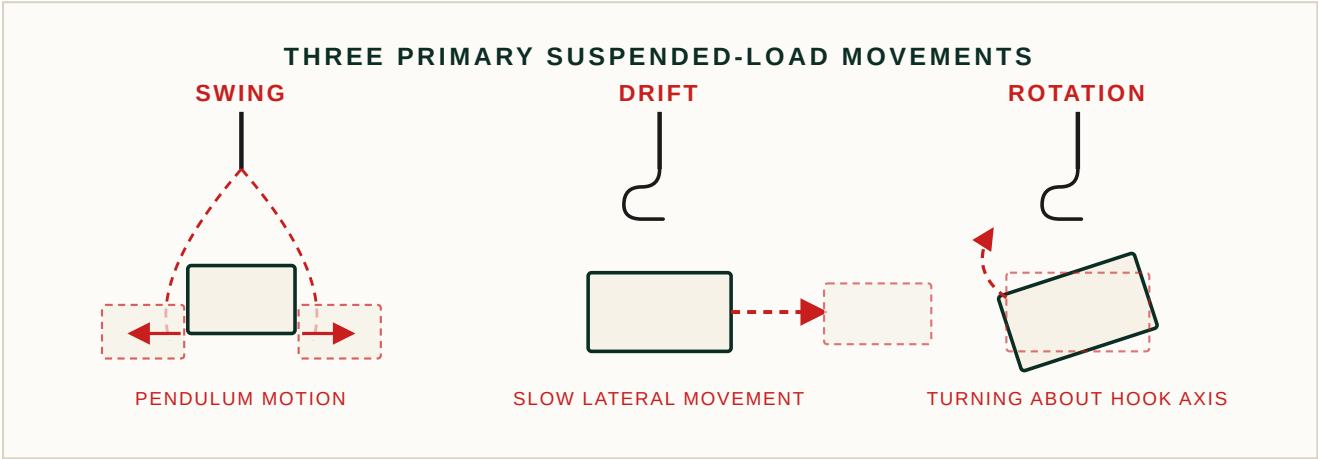


**FIGURE 3.4** — Three primary suspended-load movements: swing (pendulum motion, left); drift (slow lateral displacement, centre); rotation (turning about the hook axis, right). All three may occur simultaneously.

**TABLE 3.3** — COMMON SUSPENDED-LOAD MOVEMENTS

| MOVEMENT | WHAT IT LOOKS LIKE                                 | COMMON INFLUENCES                                                                 |
|----------|----------------------------------------------------|-----------------------------------------------------------------------------------|
| Swing    | Back-and-forth pendulum motion beneath the hook    | Sudden starts or stops; direction changes; wind; uneven initial lift              |
| Drift    | Slow sideways movement away from the intended path | Remaining swing; off-centre hook; crane travel; sling settling                    |
| Rotation | Load turns around its hanging position             | Uneven weight; sling twist; off-centre lifting points; wind; contact with objects |
| Tilt     | One side hangs lower than the other                | Unequal sling loading; off-centre hook; uneven weight distribution                |
| Settling | Small movement as load finds its hanging position  | Sling take-up; load balance; sling flexibility; initial lift speed                |

ROTATION AND HAND CONTACT

Rotation is often what causes workers to reach for a load. They see it turning away from the required direction and try to correct it by hand. The worker may influence the surface they touch — but the rotation is still being driven by the complete lifting arrangement.

SECTION 3.7

Moving from One Point to the Landing Area

Most routine industrial lifts involve moving a load from one location to another — a motor from the workshop floor to a maintenance bay, a steel plate from a stack to a cutting table, a gearbox from a pallet to a machine platform. The load travels through open space. Workers may stay well clear during the travel stage because there is room to do so.

As the load reaches the destination, the situation changes. The team now wants the load to land within the marked area, sit on the dunnage, face the correct direction, and remain clear of nearby equipment. This is the point where workers often step closer — and the point where hand exposure begins to develop.

A task that requires only that a load lands in the correct area and in a usable orientation is still enough to create hand exposure.

SECTION 3.8

Final Placement in a Designated Area

A designated landing area is the prepared place where the load is intended to be lowered — a marked floor area, timber blocks, a pallet, a machine platform, a vehicle bed, a vessel deck or a maintenance stand.

As the load approaches this area, workers may try to push it sideways, stop it rotating, pull one corner towards them, prevent it striking nearby equipment, align it with the dunnage, turn it into the preferred direction, or hold it steady while it is lowered. These actions feel normal because the load is almost down.

CRITICAL SAFETY POSITION

A load that is close to the ground is still a suspended load until its weight has been fully transferred onto the landing surface and the lifting equipment is no longer supporting it. That final distance matters because the load can still move sideways, rotate, trap a hand, crush fingers against the landing surface, or swing into a worker and settle differently from what was expected.

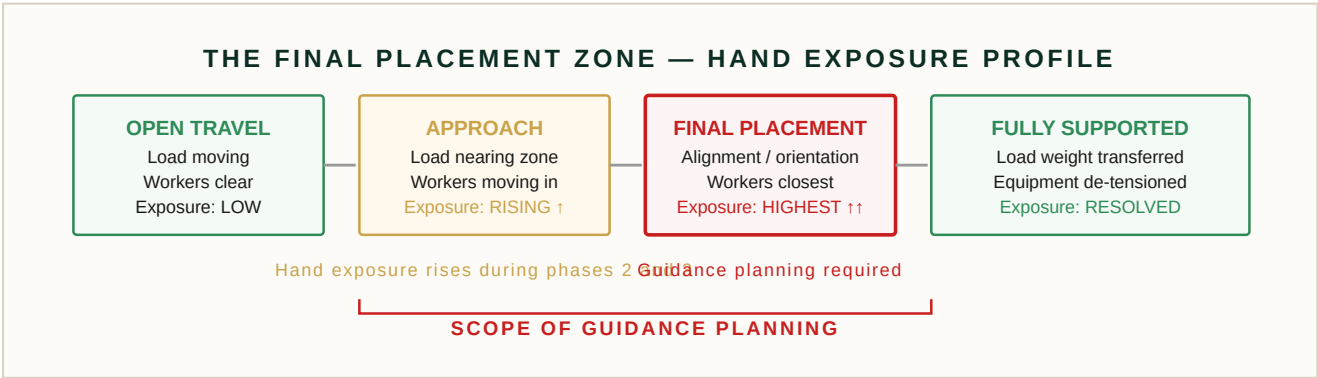


FIGURE 3.5 — Hand exposure profile across the four phases of a routine lift. Exposure rises during approach and reaches its highest point during final placement. Both phases require planned guidance methods.

SECTION 3.9

## Precision Positioning as a Special Case

Some lifting tasks require more than general placement — they require the load to align with a fixed item. Examples include a pump lowered over foundation bolts, a pipe spool positioned between flanges, a gearbox aligned with a shaft or coupling, or a fabricated component placed onto locating pins. These are **precision-positioning tasks**.

TABLE 3.4 — GENERAL PLACEMENT VERSUS PRECISION POSITIONING

| GENERAL PLACEMENT                            | PRECISION POSITIONING                                           |
|----------------------------------------------|-----------------------------------------------------------------|
| Land within a prepared area                  | Align with a fixed interface (bolt, flange, pin, coupling)      |
| Correct area and orientation required        | Exact positional tolerance required                             |
| Workers guide from outside the load envelope | Workers often approach closely to observe alignment             |
| Guidance over final metres                   | Guidance over final millimetres                                 |
| Pinch and crush risk during approach         | Additional pinch risk from fixed surfaces, bolts and guide pins |

Precision positioning requires the same planned guidance approach as general placement — but with additional attention to the fixed surfaces that create pinch points. The concentration required on millimetre alignment can draw a worker’s attention away from their own clearance.

However, precision positioning should not be treated as the *only* reason suspended loads are guided. Most guidance begins much earlier — during ordinary travel, approach, orientation and landing.

SECTION 3.10

## When the Hand Becomes the Control Interface

The human hand is an extraordinary instrument. It can sense movement, detect contact, judge direction, feel resistance, make fast corrections and apply small amounts of force with great accuracy. This is why people naturally trust their hands.

However, when a worker places a hand directly on a suspended load, the body part providing the guidance is also the body part placed closest to the hazard. The hand may be between the load and a fixed surface, below the load, beside a moving edge, near the landing point, inside the swing path, or in a place where withdrawal becomes difficult.

The hand is highly capable. The problem begins when capability requires exposure.

The engineering objective is therefore not to remove the worker’s ability to influence the load. It is to separate the worker’s hand from the load while still allowing useful guidance.

ENGINEERING PRINCIPLE

When the hand becomes the direct control point on a suspended load, control and exposure occupy the same location. Hands-off guidance methods relocate control without relocating the exposure.

SECTION 3.11

# What This Means for Everyday Lifting

Understanding suspended-load behaviour leads to six practical conclusions that should inform how guidance is planned.

TABLE 3.5 — PRACTICAL CONCLUSIONS FROM SUSPENDED-LOAD BEHAVIOUR

| CONCLUSION                          | PRACTICAL IMPLICATION                                                                                                                                                                                                                 |
|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Observe from the first lift         | The initial pickup shows how the load balances, tilts and settles. This information should inform the guidance approach before travel begins.                                                                                         |
| Smooth movement matters             | Sudden lifting, stopping or direction changes introduce movement that persists. A smooth lift reduces the amount of guidance work required later.                                                                                     |
| The whole setup matters             | Load shape, hook position, lifting points, sling arrangement and sling type all influence behaviour. Guidance planning should consider all of them.                                                                                   |
| Plan the final placement            | Workers should not be deciding how the load will be guided into the landing area at the moment the load arrives there.                                                                                                                |
| General and precision are different | Most loads need safe placement within a prepared area. A smaller number need exact alignment with bolts, flanges or pins. Both require guidance planning; precision tasks require additional attention to fixed-surface pinch points. |
| Hand contact is not the default     | Where workers are expected to push, pull, steady, turn or align a suspended load, the guidance method should be considered before the lift begins.                                                                                    |

Plan how the load will be guided before it leaves its support — not when it reaches the landing area.

CHAPTER 3

Summary of Key Positions

TABLE 3.6 — CHAPTER 3 IN BRIEF

| CONCEPT               | KEY POSITION                                                                                                                                                                                                      |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The suspended state   | A supported load is restrained by the surface beneath it. A suspended load is free to respond to every force acting on it — swing, drift, rotation, tilt and settling may occur alone or in combination.          |
| System behaviour      | Load behaviour belongs to the complete lifting setup: load shape, balance, hook position, lifting points, sling arrangement, sling type, crane movement and environment all contribute.                           |
| The initial lift      | How the load is taken from its support influences how it behaves throughout the lift. A smooth, controlled initial lift reduces movement that must be managed later.                                              |
| Centre of gravity     | A suspended load seeks to place its balance point beneath the hook. Tilt, rotation and off-centre hanging are the natural result when hook position and centre of gravity are not aligned.                        |
| Movement types        | Swing, drift, rotation, tilt and settling are predictable consequences of the suspended state — not random events. Understanding their causes is the basis for planning guidance.                                 |
| The landing zone      | Hand exposure rises from the approach phase onwards and is highest during final placement. The load remains suspended — and potentially hazardous — until its weight is fully transferred to the landing surface. |
| Precision positioning | A special case requiring additional planning, not the only case requiring guidance planning. General placement also creates hand exposure that must be addressed.                                                 |
| The hand as interface | The hand is a capable guidance instrument. It is also the body part placed closest to the hazard when used directly against the load. Engineering separates guidance from exposure.                               |

CONTINUED IN THE RIGGERSAFE® GUIDEBOOK

Chapter 4 introduces the engineering principles for hands-off suspended load guidance — building from the physical behaviour described in this chapter to the planned guidance methods and assessable requirements that form the practical core of the RiggerSafe® Guidebook.

## PUBLICATION DETAILS

## Chapter 3 — Publication Record

TABLE 3.7 — FIGURES AND TABLES INDEX

| REFERENCE  | TITLE                                                               | PAGE |
|------------|---------------------------------------------------------------------|------|
| Figure 3.1 | Supported load vs suspended load — movement states compared         | 03   |
| Figure 3.2 | What influences suspended-load behaviour — system diagram           | 04   |
| Figure 3.3 | Why a load tilts — hook position relative to centre of gravity      | 05   |
| Figure 3.4 | Three primary suspended-load movements: swing, drift, rotation      | 07   |
| Figure 3.5 | The final placement zone — hand exposure profile across four phases | 08   |
| Table 3.1  | Sling arrangement: effects on load behaviour                        | 06   |
| Table 3.2  | Sling type: behavioural characteristics                             | 06   |
| Table 3.3  | Common suspended-load movements                                     | 07   |
| Table 3.4  | General placement versus precision positioning                      | 09   |
| Table 3.5  | Practical conclusions from suspended-load behaviour                 | 10   |
| Table 3.6  | Chapter 3 in brief                                                  | 11   |

## TERMINOLOGY INTRODUCED IN THIS CHAPTER

**Centre of gravity** — the point around which the load's weight is balanced; a suspended load will move until this point sits directly beneath the hook.

**Lifting point (pick point)** — the place where a sling or lifting attachment connects to the load.

**Test lift** — the practice of raising a load a short distance and pausing to observe balance, sling take-up, tilt and rotation before proceeding with travel.

**Precision positioning** — a lifting task requiring the load to align with a fixed interface such as a bolt, flange, pin or coupling, as distinct from general placement within a prepared area.

**Designated landing area** — the prepared location where the load is intended to be lowered and fully supported.

## GENERAL NOTES

This chapter addresses suspended-load behaviour as it relates to guidance planning. It does not address rigging design, sling-selection calculations or lifting plan requirements, which remain the responsibility of competent lifting personnel and must comply with applicable standards and statutory requirements.

Application should be assessed against site-specific conditions, task risk assessments and the requirements of the controlling lifting authority.

# Chapter 4

---

## Engineering Principles for Hands-Free Suspended Load Guidance

Guidance remains an essential part of many lifting operations. This chapter does not remove it. It establishes eight engineering principles that change how guidance is achieved — replacing direct body contact with an engineered control interface, and proximity with planned separation.

- |                                                                           |                                                                         |
|---------------------------------------------------------------------------|-------------------------------------------------------------------------|
| <b>1</b> Engineer the work before expecting behavioural change            | <b>2</b> Eliminate unnecessary direct body contact                      |
| <b>3</b> Replace direct body contact with an engineered control interface | <b>4</b> Maintain the greatest practical separation                     |
| <b>5</b> Control every suspended load without direct body contact         | <b>6</b> Enhance — do not replace — the rigger's judgement              |
| <b>7</b> Prepare the guidance method before the lift begins               | <b>8</b> The best time to prepare is before the load leaves its support |

## CHAPTER OVERVIEW

## Building on the Foundations

The previous chapters established two important foundations.

The first: workers naturally reach for suspended loads because direct touch has been reinforced throughout life as the most familiar way of guiding and positioning objects. The second: suspended loads behave differently from supported objects — once lifted, they respond to gravity, balance, momentum, crane movement and the lifting arrangement rather than to the intentions of the worker.

Understanding these foundations naturally leads to the next question: **How should suspended loads be guided?**

Hands-free suspended load guidance does not ask workers to stop guiding loads. It does not remove the need to control the movement and orientation of a suspended load. Instead, it changes how that control is achieved. Rather than relying on direct body contact, it replaces direct body contact with an engineered control interface that allows workers to control orientation and intended path while maintaining greater separation from the energy source.

The engineering objective remains unchanged: move the load safely, position it accurately, place it where it is required. The method changes. The worker no longer needs to become the primary point of contact between the body and the suspended load.

## CHAPTER AT A GLANCE

1. Engineering before behaviour
2. Eliminate unnecessary direct body contact
3. Replace the control interface
4. Maintain practical separation
5. Control without direct body contact
6. The role of the rigger
7. Engineering the guidance method
8. Worker positioning during guidance
9. Selecting the appropriate guidance method
10. Before the load leaves the ground
11. Practical guidance checklist
12. Chapter summary

**TWO CORE TERMS — USED CONSISTENTLY THROUGHOUT THIS CHAPTER AND THE REMAINDER OF THE SERIES**

**Direct body contact** — any situation in which a person uses part of their body to push, pull, steady, restrain, support or otherwise influence a mechanically suspended load. This is the condition that engineering seeks to eliminate wherever practical.

**Engineered control interface** — the method through which guidance is transmitted from the worker to the suspended load, without requiring direct body contact. The objective is to replace the body as the contact point while preserving effective control of the load's orientation and intended path.

## SECTION 4.1 · PART 1 — ENGINEERING FOUNDATIONS

## Engineering Before Behaviour

Many workplace safety programmes begin by focusing on behaviour. Workers are reminded not to place their hands beneath loads, instructed to avoid pinch points, trained to remain alert. These behavioural expectations are important. However, behaviour alone cannot overcome poor work design.

If a task repeatedly requires workers to approach, steady, push or pull a suspended load using direct body contact, the work itself should first be examined. Before asking *"Why are workers touching the load?"* the more useful engineering question is: **"Why does the task require workers to touch the load in the first place?"**

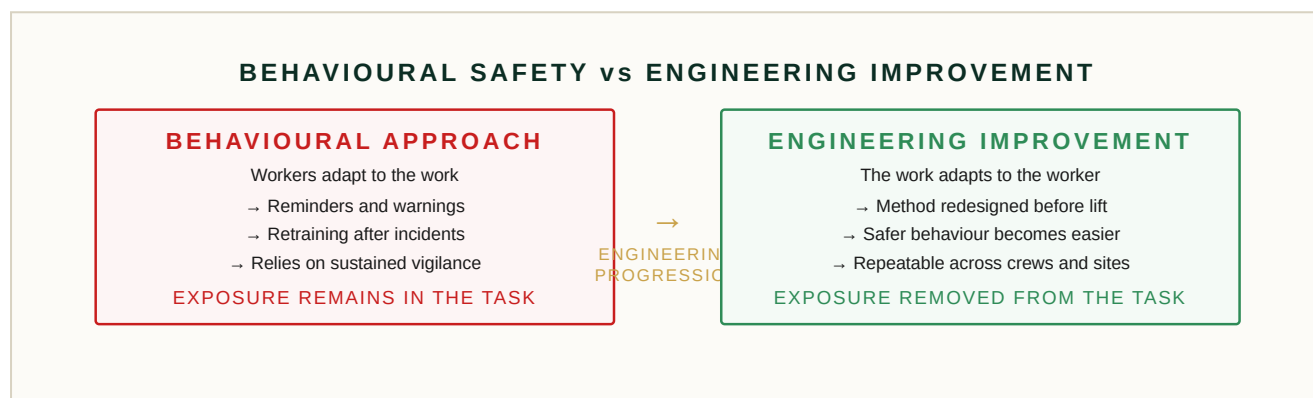


**FIGURE 4.1** — Engineering improvement adapts the work so that safer behaviour becomes the practical default. It does not replace behavioural expectations — it removes the need for workers to overcome poor work design through vigilance alone.

### 1

#### ENGINEERING PRINCIPLE 1

Engineer the work before expecting workers to change their behaviour. Good engineering removes unnecessary direct body contact before relying on human judgement.

#### FIELD OBSERVATION

A maintenance team has lowered gearboxes into a repair bay for many years. Each lift requires two technicians to stand beside the gearbox and rotate it into position using direct body contact. No injuries have occurred, but every lift depends on the same manual intervention.

Rather than asking the technicians to "be more careful," the maintenance team redesigns the guidance method so the gearbox can be rotated from a safer stand-off distance using an engineered control interface. The task remains the same. The direct body contact does not.

## SECTION 4.2

## Eliminate Unnecessary Direct Body Contact

Workers guide suspended loads because the work requires guidance. Hands-free suspended load guidance does not attempt to eliminate guidance. It seeks to eliminate unnecessary direct body contact during guidance.

**DEFINITION · DIRECT BODY CONTACT**

Any situation in which a person uses part of their body to push, pull, steady, restrain, support or otherwise influence a mechanically suspended load.

Although hands are most commonly involved, direct body contact also occurs when workers use shoulders, hips, knees, feet, thighs or the entire body to influence a suspended load. The engineering objective extends beyond hand safety alone.

Hands-free suspended load guidance means preventing unnecessary direct body contact with a mechanically suspended load until:

- the load has been fully supported,
- lifting forces have been removed,
- and the load is no longer capable of unintended movement resulting from the lifting operation.

This principle recognises an important distinction. A worker may still control the orientation of the load. The difference is that control is achieved through an engineered control interface — without requiring direct body contact.

## 2

**ENGINEERING PRINCIPLE 2**

Eliminate unnecessary direct body contact with mechanically suspended loads wherever practical. Removing direct body contact does not eliminate the task — it changes the method by which the task is performed.

## SECTION 4.3

## Replace the Control Interface

Every suspended load requires guidance. Historically, the worker's body has become the point through which that guidance is applied — the body becomes the control interface.

Engineering introduces a different approach. Rather than placing the body in direct contact with the suspended load, guidance is provided through an engineered control interface that allows the worker to remain at a safer stand-off distance. The worker still performs the task. The worker still controls the orientation and intended path of the load. The difference lies in where the control is applied.

**DEFINITION · ENGINEERED CONTROL INTERFACE**

The method through which guidance is transmitted from the worker to the suspended load. When an engineered control interface replaces direct body contact, the worker no longer needs to occupy the immediate contact zone in order to guide the load effectively.

## 3

**ENGINEERING PRINCIPLE 3**

Replace direct body contact with an engineered control interface wherever practical. The objective has never been to remove guidance. The objective is to remove unnecessary direct body contact while maintaining effective guidance.

## SECTION 4.4

## Maintain Practical Separation

Distance is one of the simplest engineering controls available during suspended-load guidance.

As separation between personnel and the suspended load increases, the worker has more time to recognise unexpected movement; the body is less likely to become trapped; pinch points become easier to avoid; and escape routes remain more accessible. The worker is no longer positioned where even a small movement can immediately result in injury.

This does not mean workers should stand as far away as possible. Every lifting task has practical limits. The objective is to maintain the greatest practical separation that still allows effective guidance.

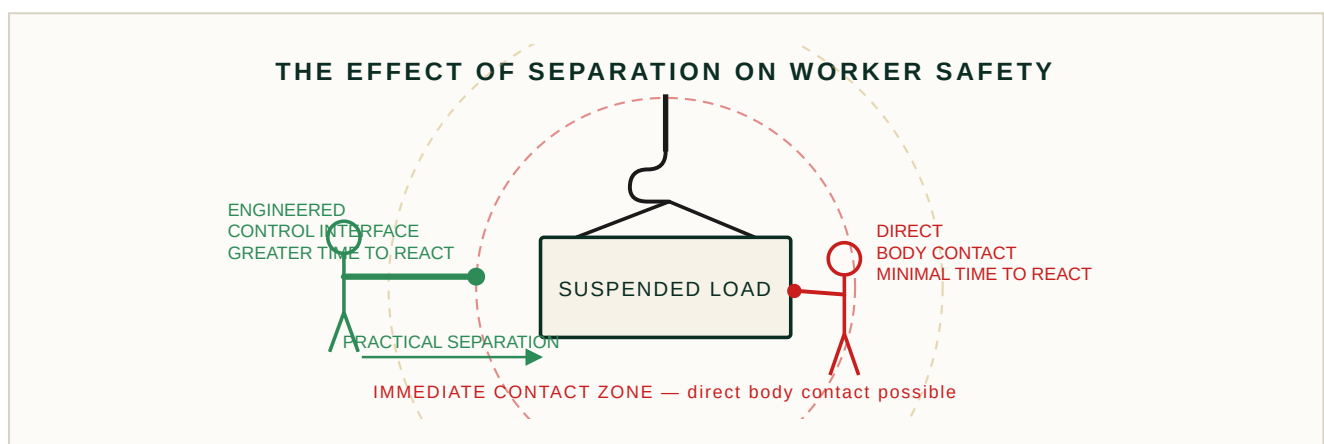


**FIGURE 4.2** — Two workers guiding the same suspended load. Worker A (right) maintains direct body contact within the immediate contact zone. Worker B (left) uses an engineered control interface to guide from a safer stand-off distance, with greater time to recognise and respond to unexpected movement.

## 4

## ENGINEERING PRINCIPLE 4

Maintain the greatest practical separation that still allows effective guidance of the suspended load. The required distance varies by task — the principle does not.

## CONTEXT — BEFORE APPLYING THE PRINCIPLES

## Where This Guidebook Sits

The RiggerSafe® Engineering Method does not replace regulations, lifting standards or the professional judgement of competent riggers. It operates within all of them — improving only the physical method through which guidance is applied.

The following figure establishes that position clearly. It should be read before the engineering principles are applied in practice.

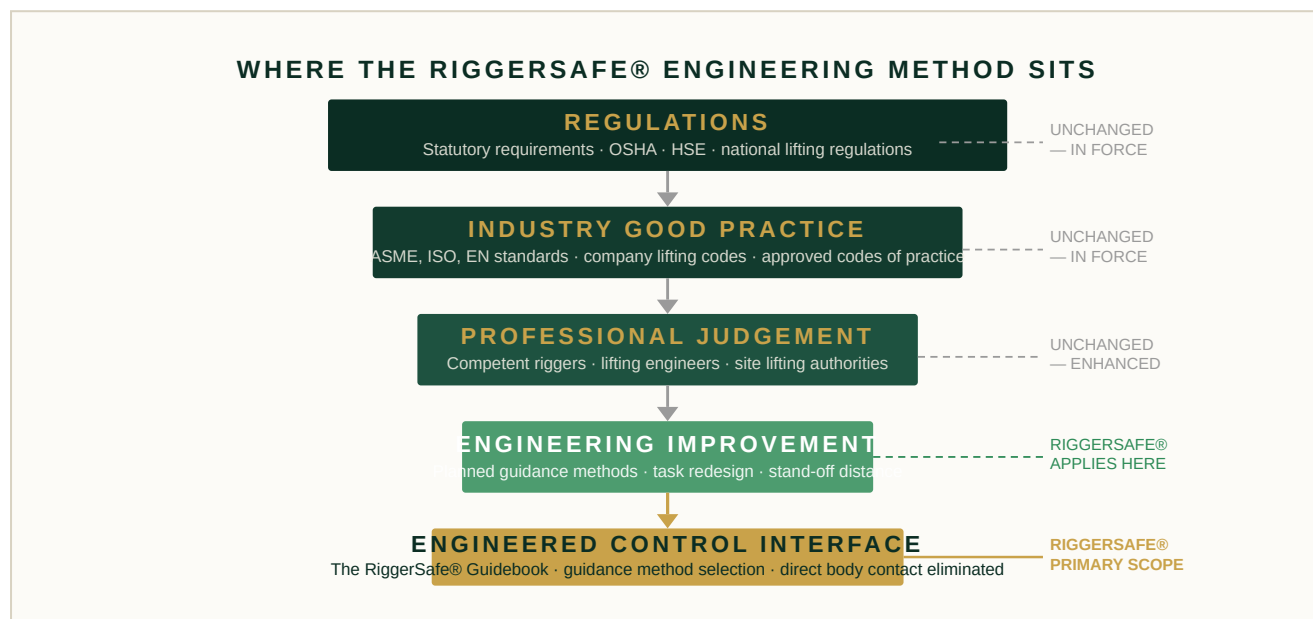


**FIGURE 4.3** — The RiggerSafe® Engineering Method sits within — and does not replace — the existing hierarchy of regulations, industry standards and professional rigger judgement. It improves only the physical method through which guidance is applied at the point of task.

**IMPORTANT — ENGINEERING RECOMMENDATION, NOT REGULATORY REQUIREMENT**

The RiggerSafe® Engineering Method recommends eliminating direct body contact wherever the task can be safely performed through an engineered control interface. This is an engineering recommendation — not a quotation from any regulatory body. It does not supersede OSHA, HSE, or any applicable statutory or industry lifting requirement. All guidance in this guidebook is supplementary to, and operates within, the regulatory and industry framework applicable to the site and jurisdiction.

## SUPPLEMENTARY CONTEXT

## The Hierarchy of Controls

The Hierarchy of Controls is a recognised framework used across industries to prioritise the means by which workplace hazards are managed. It ranks controls from the most effective — eliminating the hazard entirely — to the least effective — relying on personal protective equipment.

Understanding where hands-free suspended load guidance sits within this hierarchy gives the engineering principles of this chapter their proper academic standing.

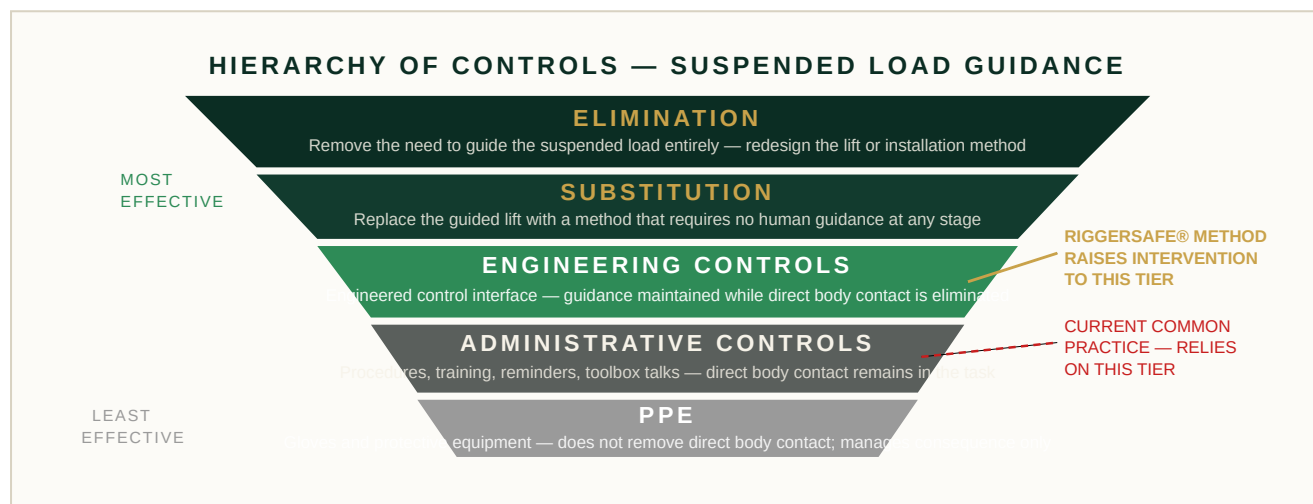


**FIGURE 4.4** — The Hierarchy of Controls applied to suspended load guidance. Current common practice relies on administrative controls — procedures and training — which leave direct body contact in the task. The RiggerSafe® Engineering Method moves the primary intervention to the engineering control tier by introducing an engineered control interface.

### THE CONTROL TIER THAT CHANGES

**Direct body contact is an administrative or work-practice control.** It relies on workers modifying their behaviour in response to training and reminders. The hazard — suspension of the load — remains present throughout.

**An engineered control interface is an engineering control.** It physically changes the method so that direct body contact is no longer required to perform the task. The same guidance outcome is achieved at a higher tier of the hierarchy — and with greater reliability across crews, shifts and sites.

SECTION 4.5 · END OF PART 1 — ENGINEERING FOUNDATIONS

# Control the Load Without Direct Body Contact

Every suspended load requires controlled guidance appropriate to the task. Loads do not become safer by allowing them to move freely. They become safer when their movement is planned, anticipated and guided under control.

The engineering objective is therefore not in question. Guidance is necessary. What the engineering question addresses is: **How can that guidance be achieved without requiring direct body contact between personnel and the suspended load?**

During guidance, the worker may legitimately influence rotation, adjust orientation, guide the load towards its landing area, keep it clear of surrounding equipment and assist final placement. These are proper parts of suspended-load guidance.

However, through the application of an engineered control interface, the worker should never need to become:

TABLE 4.1 — FUNCTIONS THAT BELONG TO THE LIFTING SYSTEM, NOT THE WORKER'S BODY

| ROLE THE BODY MUST NOT FILL                     | WHERE THAT FUNCTION BELONGS                                      |
|-------------------------------------------------|------------------------------------------------------------------|
| The brake that stops swing                      | Planned guidance method; crane operator timing; landing sequence |
| The buffer that absorbs impact                  | Landing area preparation; approach speed control                 |
| The restraint that arrests movement             | Lifting arrangement and engineered control interface             |
| The support that carries part of the load       | The lifting system — crane, rigging and mechanical support only  |
| The barrier between the load and a fixed object | Exclusion zone, spatial planning and approach path design        |

5

ENGINEERING PRINCIPLE 5

Every suspended load requires controlled guidance appropriate to the task. The engineering objective is to achieve that guidance without direct body contact.

PART 1 — CLOSING POSITION

The first five engineering principles establish the foundation of hands-free suspended load guidance. They recognise that guidance remains an essential part of many lifting operations, but they change how that guidance is achieved. Rather than relying on direct body contact, the methodology replaces it with an engineered control interface that maintains effective control while increasing separation between personnel and the suspended load.

These principles provide the foundation for the remainder of this chapter, which addresses how they are applied during planning, worker positioning, approach and final placement.

## SECTION 4.6 · PART 2 — APPLICATION

## The Role of the Rigger

Every successful lifting operation depends upon the judgement, experience and situational awareness of competent riggers. Equipment, procedures and lifting plans are essential, but they cannot replace the decisions made by the people guiding the load.

Experienced riggers develop an instinct for suspended loads through years of observation and practice. They recognise when a load is stable and when it requires attention. They understand when to allow a load to settle naturally, when to correct unwanted movement and when to leave it alone.

**Hands-free suspended load guidance is founded on this experience. It does not replace the rigger's judgement. It does not automate the task.** It changes only the physical interface through which the rigger applies that judgement. Instead of direct body contact, the rigger uses an engineered control interface that allows the same corrections to be made while maintaining greater separation.

### WHAT THE RIGGER CONTINUES TO DECIDE

- When guidance is required.
- How much correction should be applied.
- When to stop guiding the load.
- When the load should be allowed to settle naturally.
- When the load has reached its intended position.

The engineered control interface makes none of these decisions. It provides a safer means of applying them.

### FIELD OBSERVATION

Watch an experienced rigger during a routine lifting operation. Most of the time, the suspended load is allowed to travel without interference. Then, almost instinctively, the rigger makes a small correction — to prevent rotation, to align the load with its destination, or to prepare for landing.

The intervention is brief. It is deliberate. It is based on experience. Hands-free suspended load guidance preserves this judgement while replacing direct body contact with an engineered control interface.

## 6

### ENGINEERING PRINCIPLE 6

Hands-free suspended load guidance enhances the rigger's skill. It does not replace it. The engineered control interface is a better means of applying the rigger's judgement — not a substitute for it.

## SECTION 4.7

## Engineering the Guidance Method

Every lift is planned. The crane is selected, the lifting equipment is inspected, the lifting points are identified and the travel path is reviewed. The guidance method deserves the same level of consideration.

This does not mean predicting every movement of the load, or deciding exactly when the rigger will intervene. Suspended loads are influenced by changing conditions — balance, momentum, crane movement, wind, restricted access and the surrounding work environment. The timing of guidance therefore remains the responsibility of the rigger.

**Planning focuses on ensuring that the appropriate means of guidance is available whenever it becomes necessary.**

### QUESTIONS FOR GUIDANCE METHOD PLANNING

- Will the load require changes in orientation during travel?
- Is rotation likely?
- Will the load pass through confined or congested areas?
- Does the landing require careful positioning?
- Can direct body contact be avoided throughout?
- Is an appropriate engineered control interface available for this task?

Planning prepares the method. Professional judgement determines when that method is applied.

## 7

### ENGINEERING PRINCIPLE 7

Prepare the guidance method before lifting begins. Apply it only when the task requires it. Timing remains the rigger's responsibility — the method should be ready before it is needed.

## SECTION 4.8

## Worker Positioning During Guidance

Where a rigger stands is often as important as how the load is guided. Good positioning provides visibility, balance and a clear path away from unexpected movement. Poor positioning can place the body between the suspended load and surrounding structures, leaving little opportunity to react if conditions change.

### ENGINEERING INSIGHT

*The safest rigger is not always the one standing furthest from the load. It is the one who maintains effective control while avoiding unnecessary direct body contact. Distance alone does not create safety. Good positioning combined with good judgement does.*

Whenever guidance becomes necessary, the rigger should maintain a position that provides clear visibility of the load and its destination; avoids standing between the load and fixed objects; maintains a balanced stance without overreaching; preserves a clear escape route; and allows the engineered control interface — not the body — to become the point of contact with the suspended load.

SECTION 4.9

# Selecting the Appropriate Guidance Method

Not every suspended load behaves in the same way, and the guidance method should reflect the demands of the task rather than habit or personal preference.

Factors that influence the selection of an engineered control interface include: the size and geometry of the load; the lifting arrangement; expected rotation or drift; travel distance; environmental conditions such as wind; available working space; visibility; and the level of positioning accuracy required during landing.

**The objective is not to use the same method for every lift.** It is to provide the rigger with an engineered control interface appropriate to the task, enabling professional judgement to be applied effectively while reducing unnecessary direct body contact.

TABLE 4.2 — TYPICAL GUIDANCE CONSIDERATIONS BY OPERATIONAL SITUATION

| OPERATIONAL SITUATION                           | PRIMARY GUIDANCE REQUIREMENT                                                                                      |
|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| Long travel distance through open space         | Maintain orientation when required; allow natural settling between corrections                                    |
| Wind or air movement acting on the load         | Correct unwanted drift or rotation using an engineered control interface from a stand-off position                |
| Restricted access — confined or congested areas | Maintain effective control while preserving the greatest practical separation from fixed structures               |
| General placement in a designated area          | Guide the load into its intended landing area; orient correctly; avoid adjacent equipment                         |
| Precision placement — bolts, flanges, pins      | Make controlled adjustments during final positioning; additional attention required to fixed-surface pinch points |

FIELD OBSERVATION

Two identical pumps are lowered onto separate maintenance stands. In one lift, the technician remains beside the pump throughout the landing, using direct body contact to guide it into position. In the second, the technician guides the pump from outside the immediate contact zone using an engineered control interface.

Both pumps are landed successfully. Only one method required the worker to maintain direct body contact within the hazard zone throughout the operation.

ENGINEERING INSIGHT

*The engineered control interface does not determine when the rigger intervenes. It determines how the rigger intervenes safely when intervention becomes necessary.*

## SECTION 4.10

## Before the Load Leaves the Ground

The safest lifting operations are rarely the result of good reactions. They are the result of good preparation.

Before the load becomes suspended, the lifting team should consider how guidance will be achieved if it becomes necessary. These questions do not replace the rigger's judgement — they ensure the rigger has the appropriate engineered control interface available to apply that judgement safely when the moment arrives.

### PRE-LIFT GUIDANCE QUESTIONS

- Can direct body contact be avoided throughout this lift?
- Is the selected engineered control interface appropriate for this load?
- Has the landing area been prepared?
- Is there sufficient working space to guide the load safely?
- Are escape routes available and unobstructed?
- Does the lifting team understand the expected behaviour of this load?

## 8

### ENGINEERING PRINCIPLE 8

The best time to prepare for suspended load guidance is before the load leaves its support. Once the load is suspended, the time for method selection has passed.

## SECTION 4.11

## Practical Guidance Checklist

Before lifting begins, confirm that:

- ✓ Direct body contact has been eliminated wherever practical.
- ✓ An appropriate engineered control interface is available for this lift.
- ✓ The landing area has been prepared.
- ✓ Personnel understand the expected behaviour of the load.
- ✓ Escape routes remain unobstructed.
- ✓ Sufficient working space exists to guide the load safely if required.
- ✓ Responsibilities for communication and guidance have been clearly understood by all members of the lifting team.

## SECTION 4.12

## Chapter Summary

Suspended load guidance is a skilled activity that relies on the judgement and experience of competent riggers. Hands-free suspended load guidance does not attempt to replace that judgement. It improves the method through which it is applied — replacing direct body contact with an engineered control interface and proximity with planned separation.

Eight engineering principles have been introduced in this chapter. Together, they establish a practical framework for reducing unnecessary direct body contact while preserving effective control of suspended loads.

**1 ENGINEER THE WORK FIRST**  
Engineering improvement removes exposure before relying on worker behaviour to manage it.

**2 ELIMINATE DIRECT BODY CONTACT**  
Unnecessary direct body contact with mechanically suspended loads should be eliminated wherever practical.

**3 REPLACE THE CONTROL INTERFACE**  
Direct body contact is replaced by an engineered control interface that transmits guidance from a safer position.

**4 MAINTAIN PRACTICAL SEPARATION**  
The greatest practical separation that still allows effective guidance should always be maintained.

**5 GUIDANCE WITHOUT BODY CONTACT**  
Every suspended load requires controlled guidance appropriate to the task — achieved without direct body contact.

**6 ENHANCE THE RIGGER'S SKILL**  
The engineered control interface is a better means of applying rigger judgement — not a substitute for it.

**7 PREPARE BEFORE LIFTING**  
The guidance method is prepared before the lift begins; professional judgement determines when it is applied.

**8 ACT BEFORE SUSPENSION**  
The best time to prepare for suspended load guidance is before the load leaves its support.

### CONTINUED IN THE RIGGERSAFE® GUIDEBOOK

The next chapters apply these eight engineering principles to specific lifting scenarios — addressing approach paths, final placement, precision positioning and the practical selection of engineered control interfaces for routine industrial tasks.

PUBLICATION DETAILS

Chapter 4 — Publication Record

TABLE 4.3 — FIGURES AND TABLES INDEX

| REFERENCE  | TITLE                                                                                           | PAGE |
|------------|-------------------------------------------------------------------------------------------------|------|
| Figure 4.1 | Behavioural safety vs engineering improvement — comparison diagram                              | 03   |
| Figure 4.2 | The effect of separation on worker safety — direct body contact vs engineered control interface | 05   |
| Table 4.1  | Functions that belong to the lifting system, not the worker's body                              | 06   |
| Table 4.2  | Typical guidance considerations by operational situation                                        | 09   |
| Table 4.3  | Figures and tables index (this table)                                                           | 12   |

TERMINOLOGY FORMALISED IN THIS CHAPTER — USED THROUGHOUT THE SERIES

**Direct body contact** — any situation in which a person uses part of their body (hands, arms, shoulders, hips, knees, feet or the entire body) to push, pull, steady, restrain, support or otherwise influence a mechanically suspended load. This is the condition that hands-free guidance engineering seeks to eliminate wherever practical.

**Engineered control interface** — the method through which guidance is transmitted from the worker to the suspended load without requiring direct body contact. The engineered control interface is the replacement for the body as the point of interaction between the worker and the load. It allows the same guidance decisions to be applied from a safer stand-off distance.

**Immediate contact zone** — the area immediately surrounding a suspended load in which a worker's body can come into direct contact with the load or with fixed objects as a result of the load's movement. Workers should remain outside the immediate contact zone whenever the engineered control interface allows effective guidance to be maintained from that position.

**Practical separation** — the greatest distance from the suspended load at which a worker can still maintain effective guidance using the available engineered control interface. Practical separation is a function of the load, the task and the guidance method — not a fixed dimension.

CHAPTER 4 · DEFINING STATEMENT

Professional riggers have always controlled suspended loads.  
The RiggerSafe® Guidebook changes only one thing:  
the body is no longer the interface through which that control is applied.

# Chapter 5

---

## From Pick-Up to Final Placement

### *Applying Hands-Free Suspended Load Guidance*

A lifting operation is not one continuous action. It is a sequence of changing conditions — each with its own requirements for observation, positioning, guidance and restraint. This chapter applies the engineering principles of Chapter 4 to every stage of that sequence, from the moment before the load leaves its support to the moment its weight is fully transferred to the landing surface.

The established lifting operation remains.

The human body is removed as the control interface.

CHAPTER 5 GOVERNING PRINCIPLE

## CHAPTER OVERVIEW

## A Sequence of Changing Conditions

Experienced riggers understand that a lifting operation is not one continuous action. It is a sequence of changing conditions beginning before the load leaves its support and ending only after the load has been landed, fully supported and confirmed stable.

During much of that sequence, the suspended load may require no physical guidance. The rigger observes its behaviour, monitors its path and remains ready to act if conditions change. When guidance becomes necessary, the rigger must still decide whether the load should settle naturally, whether a correction is required, the direction and magnitude of that correction, and when the input should be removed.

**Hands-free suspended load guidance does not change these decisions. It changes the physical method used to carry them out.**

## CHAPTER AT A GLANCE

1. The lifting operation comes first
2. Before the load leaves its support
3. Pick-up and initial observation
4. Accompanying the lifting operation
5. Communication during guidance
6. Deciding when guidance is required
7. Establishing the engineered control interface
8. Applying the minimum effective input
9. Repositioning as the lift progresses
10. Final approach and landing
11. When guidance is not the answer
12. The practical hands-free sequence
13. Chapter summary

## SECTION 5.1

## The Lifting Operation Comes First

RiggerSafe® does not create a separate system of lifting. The approved lifting plan, applicable regulations, equipment manufacturer's instructions, site procedures and the authority of the person responsible for the operation continue to govern the lift in every respect.

The engineered control interface is introduced only where the rigger would otherwise use a hand, arm, shoulder, hip, leg or another part of the body to influence the suspended load. It does not alter the command structure of the operation.

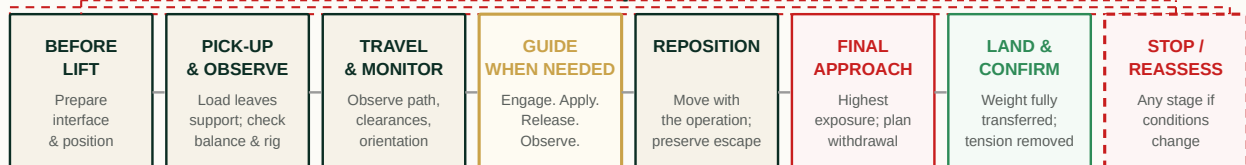
**COMMAND STRUCTURE — WHAT EVERY LIFTING TEAM MEMBER MUST UNDERSTAND**

- Who controls the primary movement of the load (the crane operator).
- Who is authorised to give routine signals to the crane operator.
- Who will apply guidance where required (the designated rigger).
- Who is monitoring the travel path and landing area.
- How the lift will be stopped if a concern develops.

While a load remains mechanically suspended and capable of unintended movement, no part of the rigger's body should be used to push, pull, turn, steady, align, stop or cushion it when the task can be performed through a suitable engineered control interface.

**REGULATORY ALIGNMENT · OSHA 29 CFR 1926.1425 / 1926 SUBPART CC**

This approach is consistent with the hierarchy of controls, which prioritises engineering solutions before dependence on work practices and personal behaviour. Current OSHA requirements direct employers to use available hoisting routes that minimise exposure to hoisted loads and restrict fall-zone access to people whose presence is necessary for functions such as guiding or receiving the load.

**THE LIFTING OPERATION SEQUENCE — STAGE OVERVIEW**

STOP / REASSESS IS AVAILABLE AT EVERY STAGE — NOT ONLY AT THE END

GUIDANCE STAGE  
ENGINEERED CONTROL INTERFACE IN USE

HIGHEST DIRECT BODY CONTACT RISK  
FINAL APPROACH STAGE

EXPOSURE  
RESOLVED

**FIGURE 5.1** — The lifting operation as a sequence of stages. The engineered control interface is active during the guidance and final approach stages. Stop and reassess is available — and may be required — at any point in the sequence.

## SECTION 5.2

## Before the Load Leaves Its Support

The time to prepare for guidance is before the load becomes suspended. This does not mean predicting every correction that will be required. It means ensuring that when guidance becomes necessary, the lifting team does not have to improvise.

### PRE-LIFT GUIDANCE PREPARATION

- Intended travel route reviewed; likely guidance positions identified.
- Required landing orientation understood.
- Whether rotation or drift may require correction — and from which direction.
- Type and reach of the engineered control interface confirmed appropriate.
- Whether a suitable contact point exists on the load for the interface.
- Whether the interface can be released freely without becoming trapped.
- The rigger's movement and escape paths planned.
- Communication method confirmed with the crane operator and signal person.

### FIELD OBSERVATION

A lifting team prepares a large valve for transfer to a foundation. The rigging is correct, the route is clear and the landing area is ready. The rigger expects that only a small orientation correction may be required during final placement. The engineered control interface is positioned nearby before lifting begins.

The valve travels most of the route without interference. When a correction becomes necessary, the rigger does not have to step towards the valve or search for equipment. The interface is already available.

### ENGINEERING INSIGHT

A tool stored elsewhere provides no protection when the rigger instinctively reaches towards a load that has already begun to move. Preparation does not decide when the rigger will intervene — it ensures a safer means of intervention is ready.

## SECTION 5.3

## Pick-Up and Initial Observation

The first few moments after the load leaves its support often reveal how it will behave throughout the lift. As the rigging takes the weight, the rigger observes whether the slings and attachments are seating as expected, whether the load rises in the intended attitude, whether the balance is consistent with the lifting plan, and whether unexpected rotation, tilt or movement is developing.

The purpose of the initial lift is not to force an incorrectly rigged load into position. If the load rises unexpectedly, the correct response may be to lower it and correct the rigging arrangement. Neither the rigger's body nor the engineered control interface should be used to compensate for unsuitable lifting points, improperly seated rigging, unsecured components or an unsafe lifting configuration. **The interface guides a properly suspended load. It does not correct a defective lift.**

SECTION 5.4

Accompanying the Lifting Operation

Where the route, visibility, load behaviour or lifting plan requires continuous observation, a designated rigger may accompany the operation from pick-up to final placement. This does not mean the load must be guided throughout its journey — it means the operation remains observed and that a competent person is available if conditions change.

WHAT THE ACCOMPANYING RIGGER IS MONITORING

- Load orientation and any developing rotation or drift.
- Clearances from structures and equipment along the travel path.
- Behaviour of the rigging arrangement.
- The approach to the landing position and available guidance positions.
- Changes in the work area — personnel, vehicles, obstructions.

Continuous readiness does not mean continuous guidance. Do not disturb a load that is already doing what is required.

POSITIONING PRINCIPLE

Accompanying the operation does not mean walking directly beneath the load or following its footprint. The rigger's position changes continuously according to direction of travel, working space, visibility, and the likely direction of any unintended movement. *Accompany the operation — not the footprint of the suspended load.*

REGULATORY ALIGNMENT · OSHA 1926.1425

Current OSHA requirements direct employers to use hoisting routes that minimise exposure to hoisted loads and restrict fall-zone access to people whose presence is necessary for functions such as guiding or receiving the load.

SECTION 5.5

Communication During Guidance

The crane creates the primary movement. The engineered control interface applies a limited guidance input. These actions must be coordinated. The rigger must not attempt to correct the load in one direction while the crane operator is unknowingly moving it in another.

TABLE 5.1 — COMMUNICATION REQUIREMENTS DURING GUIDANCE

| REQUIREMENT                           | STANDARD                                                                               |
|---------------------------------------|----------------------------------------------------------------------------------------|
| Identity of the signal person         | Established before the lift; known to the crane operator and all riggers.              |
| Request to slow, pause or stop        | Method agreed and understood by all members of the lifting team.                       |
| Communication as personnel reposition | Maintained throughout; repositioning must not break the signal chain.                  |
| Loss of communication                 | The part of the operation requiring signals must stop until communication is restored. |
| Safety problem identified             | Any member of the team may give a stop or emergency-stop signal.                       |

The crane operator controls the lift. The rigger influences orientation. Communication connects the two.

REGULATORY ALIGNMENT · OSHA 1926.1419 / 1926.1418

OSHA requires the operator to stop when a safety problem must be resolved, and permits anyone recognising a safety problem to give a stop or emergency-stop signal. The operator has authority to stop and refuse to handle a load whenever there is a safety concern.

SECTION 5.6

Deciding When Guidance Is Required

A skilled rigger does not guide a load merely because an interface is available. The rigger first observes what the load is doing. Most of the journey may require no input at all.

TABLE 5.2 — OBSERVE BEFORE ACTING: CONDITIONS AND APPROPRIATE RESPONSE

| OBSERVED CONDITION                                                                                  | APPROPRIATE RESPONSE                                                                   |
|-----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| Travelling in the required orientation, clearing structures, responding correctly to crane movement | Observe. No guidance input necessary.                                                  |
| Slow, limited rotation developing before it becomes significant                                     | Apply a small, controlled correction through the engineered control interface.         |
| Minor change of orientation required before entry into restricted space                             | Apply a controlled correction from a workable position.                                |
| Load requires small final positioning adjustment at landing                                         | Guide through the engineered control interface; withdraw before load is fully lowered. |
| Load movement increasing rapidly; swing or rotation accelerating                                    | Stop or pause the operation and reassess.                                              |
| Load has snagged or contacted an obstruction                                                        | Stop immediately. Do not push, pull or pry to free it.                                 |

ENGINEERING PRINCIPLE

Do not interfere with a load that is already doing what is required. Unnecessary input can create movement rather than control it.

SECTION 5.7

Establishing the Engineered Control Interface

Before applying force, the rigger must establish a workable position and a suitable point of contact on the load.

WORKABLE POSITION — REQUIREMENTS

- Clear view of the load and intended direction of movement.
- Clear of likely trapping or crushing points.
- Balance maintained without leaning onto the interface.
- Correction achievable without overreaching.
- Ability to step away if the load moves unexpectedly.
- Interface can be disengaged freely at any moment.

CONTACT POINT — WHAT TO AVOID

- Points where the interface may slide suddenly.
- Entry into a pinch point between the load and a fixed surface.
- Risk of the interface becoming carried away by the load.
- Interference with slings, hooks or lifting accessories.
- Positions where the interface could become wedged or jammed.

GOVERNING REQUIREMENT

The engineered control interface must remain an instrument the rigger can release at any moment. It must never be jammed, wedged or locked against the load in a configuration that binds the rigger to the load.

SECTION 5.8

Applying the Minimum Effective Input

The purpose of guidance is to influence the suspended load — not to overpower it. A small and timely input is usually more controlled than a large and late reaction. The rigger should apply only the amount of force necessary to achieve the required correction, and remove it when the required result has been achieved.

**ENGAGE**

Establish stable contact with a suitable part of the load through the engineered control interface. Confirm the position is workable and the interface can be released freely.

**APPLY**

Introduce a controlled push, pull or directional input. Apply only the force necessary for the required correction. Do not attempt to physically arrest the mass of the load.

**RELEASE**

Remove the input when the required correction has been achieved. A suspended load may continue responding after the force has been removed — allow it to do so.

**OBSERVE**

Allow the load to respond before deciding whether another correction is necessary. Continuous pressure is not always better control.

TABLE 5.3 — OBSERVED CONDITIONS DURING GUIDANCE AND APPROPRIATE RESPONSES

| OBSERVED CONDITION                          | APPROPRIATE RESPONSE                                   |
|---------------------------------------------|--------------------------------------------------------|
| Load is stable and correctly oriented       | Observe. Do not apply unnecessary input.               |
| Slow, limited rotation is developing        | Apply a small controlled correction. Release. Observe. |
| Load requires a minor change before landing | Guide through the engineered control interface.        |
| Load movement is increasing rapidly         | Stop or pause the operation and reassess.              |
| Load has snagged or caught an obstruction   | Stop. Do not push, pull or pry it free.                |
| The interface may become trapped            | Release and reposition before continuing.              |
| Rigger is losing balance or escape space    | Disengage and stop the guidance activity.              |

ABSOLUTE LIMITS — THE INTERFACE MUST NEVER BE USED AS

- Lifting equipment or a supporting prop for any part of the load.
- A restraint capable of holding significant mass.
- A lever for freeing a snagged load (which may be storing energy).
- A brake for significant swing or momentum.
- A substitute for correct crane movement or rigging adjustment.

When the movement exceeds what can be influenced through a controlled guidance input, guidance is no longer the correct response. Stop the operation.

FIELD OBSERVATION — SECTION 5.7 / 5.8

A suspended plate requires a slight change in orientation before passing a column. The rigger selects a clear edge of the plate that allows a controlled push. The interface is placed against the plate before any force is applied.

The correction is made without the rigger reaching around the plate, placing a hand on its edge or moving into the space between the plate and the column. Once the required orientation has been achieved, the interface is removed. The plate continues without further input.

SECTION 5.9

Repositioning as the Lift Progresses

The position that is suitable at pick-up may not be suitable halfway through the route or during the final landing. There is no single fixed location from which every stage of the lift can be guided.

As the operation progresses, the rigger continuously reassesses positioning against seven criteria:

TABLE 5.4 — CONTINUOUS POSITIONING ASSESSMENT DURING THE LIFTING OPERATION

| FACTOR                         | WHAT THE RIGGER ASSESSES                                                                    |
|--------------------------------|---------------------------------------------------------------------------------------------|
| Direction of travel            | Is the current position suitable for the next likely correction, or should the rigger move? |
| Visibility                     | Can the load and its destination be clearly seen from this position?                        |
| Footing and obstructions       | Is the surface stable? Are there objects that restrict movement or escape?                  |
| Likely next intervention point | Where will the next correction most likely be required?                                     |
| Escape path                    | Is there a clear route away from the load if it moves unexpectedly?                         |
| Interface release              | Can the interface be disengaged freely from this position?                                  |
| Trapping risk                  | Is the rigger clear of the likely movement and trapping paths of the load?                  |

Repositioning must be deliberate. The rigger must not allow the interface to pull the body into following the load. Where footing, visibility, communication or clearance becomes unsuitable, the rigger should disengage, move to a better position and re-establish the interface only when it is safe to do so. Crane movement may need to be slowed or paused to permit this.

A good position is temporary. It remains good only while the conditions that made it workable continue to exist.

SECTION 5.10

Final Approach and Landing

The final approach is often the stage at which the desire to make direct contact becomes strongest. The load is close to its destination. Clearances may be small. Alignment may appear almost correct. The remaining correction may seem minor enough to make by hand.

However, the load remains mechanically suspended. Movement can still result from crane motion, rigging movement, stored momentum, an uneven landing surface or a change in load attitude. The engineering standard does not change at the final stage — it becomes more important.

LANDING AREA PREPARATION — BEFORE THE LOAD ARRIVES

- Supports or dunnage positioned correctly for the intended landing orientation.
- Loose materials and obstructions removed from within the landing zone.
- Personnel not required for receiving the load kept clear.
- Adequate access maintained for the engineered control interface.
- Space confirmed for the interface to be withdrawn before the load is fully lowered.

FINAL APPROACH — SEQUENCE OF ACTIONS

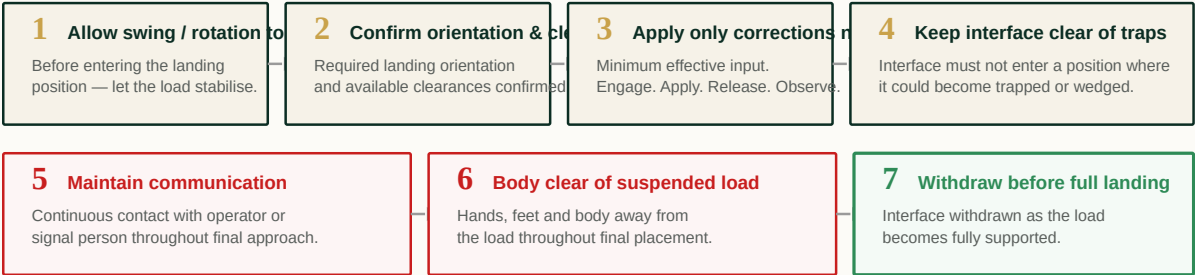


**FIGURE 5.2** — Seven-step final approach sequence. Steps 5 and 6 (communication and body clearance) are continuous requirements throughout; step 7 (interface withdrawal) resolves the exposure before the load is fully lowered.

Almost landed is still suspended. A load should be treated as suspended until its weight has been transferred to a stable support, lifting tension has been removed, and stability is confirmed.

# When Guidance Is Not the Answer

Professional judgement includes recognising when a suspended load should no longer be influenced through guidance. Applying more force is never the solution to an uncontrolled condition.

**STOP OR PAUSE THE OPERATION WHEN ANY OF THE FOLLOWING OCCUR**

- The load moves faster or further than can be safely corrected through the engineered control interface.
- Significant swing or rotation develops.
- The load snags or contacts an obstruction.
- The rigging shifts or behaves unexpectedly.
- Visibility of the load or destination is lost.
- Communication becomes unclear or interrupted.
- The rigger becomes boxed in or loses a workable position and escape path.
- The engineered control interface becomes damaged or unsuitable for the task.
- The interface may become trapped by the load or surrounding structures.
- The landing area is not ready.
- Environmental conditions change (wind increase, floor or vessel movement).
- The actual operation no longer matches the lifting plan.

TABLE 5.5 — CONDITIONS AND CONSEQUENCES: WHY STOPPING IS THE CORRECT RESPONSE

| CONDITION                               | WHY PUSHING HARDER IS WRONG                                                                                                                     |
|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| Load has snagged                        | A snagged load may be storing energy. Release of that energy when the snag clears can cause sudden, large and uncontrolled movement.            |
| Load is rotating and accelerating       | Rotation driven by the lifting arrangement cannot be stopped by a guidance input. Attempting to do so may pull the rigger into the load's path. |
| Interface may become trapped            | A trapped interface connects the rigger to the load. Any subsequent load movement pulls the body towards the hazard.                            |
| Load attitude has changed significantly | A sudden change in attitude may reflect a rigging failure or slippage. The rigging arrangement must be assessed before proceeding.              |

A professional rigger does not solve every problem by pushing harder. The correct response to an uncontrolled condition is to stop, understand it and reset the operation.

**REGULATORY ALIGNMENT · OSHA 1926.1418 / HSE GUIDANCE**

OSHA gives the operator authority to stop and refuse to handle a load whenever there is a safety concern until safety has been assured. HSE guidance likewise requires planning and supervision to remain proportionate to the foreseeable risks and complexity of the operation. Stop authority is not a last resort — it is a standard professional tool.

SECTION 5.12

The Practical Hands-Free Sequence

The application of hands-free suspended load guidance across the full lifting operation can be summarised in nine stages. Each stage is a discrete professional action — not a continuous state.

|                                                                                                                 |                                                                                                                                  |                                                                                                                   |
|-----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| <div>1</div> <div>OBSERVE</div> <div>Understand what the load is doing before attempting to influence it.</div> | <div>2</div> <div>POSITION</div> <div>Take a workable position: visibility, balance, separation and a means of withdrawal.</div> | <div>3</div> <div>ENGAGE</div> <div>Establish the engineered control interface at a suitable contact point.</div> |
|-----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|

|                                                                                                                 |                                                                                                                                      |                                                                                                             |
|-----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| <div>4</div> <div>GUIDE</div> <div>Apply the minimum controlled input required to achieve the correction.</div> | <div>5</div> <div>RELEASE</div> <div>Remove the input once the correction has been achieved. Do not maintain continuous force.</div> | <div>6</div> <div>REASSESS</div> <div>Observe how the load responds before making another correction.</div> |
|-----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|

|                                                                                                                               |                                                                                                                                                                |                                                                                                                                          |
|-------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| <div>7</div> <div>REPOSITION</div> <div>Move with the progress of the operation without following the load into danger.</div> | <div>8</div> <div>LAND</div> <div>Maintain hands-free guidance until the load is fully supported, lifting tension is removed and stability is confirmed.</div> | <div>9</div> <div>STOP WHEN NECESSARY</div> <div>When conditions exceed safe guidance, pause the lift. Reassess before continuing.</div> |
|-------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|

|                                      |                                                                                                                                                                                                                     |
|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div>THE PROFESSIONAL STANDARD</div> | <div>Continuous observation. Selective intervention. Practical separation. The right input, from a workable position, at the right moment, through the right interface — and removed when no longer required.</div> |
|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

SECTION 5.13

Chapter Summary

Hands-free suspended load guidance must operate within established lifting practice. Chapter 5 has applied the engineering principles of Chapter 4 to the complete lifting sequence — from preparation before the load leaves its support to the moment it is fully landed and confirmed stable.

TABLE 5.6 — CHAPTER 5 IN BRIEF: WHAT CHANGES AND WHAT DOES NOT

| WHAT HANDS-FREE GUIDANCE DOES NOT CHANGE                  | WHAT IT CHANGES                                                                                                                                                                                                                                                                                                                                       |
|-----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The requirement for competent planning and a lifting plan | The point at which the rigger physically interacts with the suspended load.<br><br>Instead of using the body to push, pull, steady, orient, align, stop or cushion the load, the rigger applies professional judgement through an engineered control interface — from a workable position that maintains practical separation from the energy source. |
| The authority of the crane operator                       |                                                                                                                                                                                                                                                                                                                                                       |
| The role and authority of the signal person               |                                                                                                                                                                                                                                                                                                                                                       |
| The requirement for clear, maintained communication       |                                                                                                                                                                                                                                                                                                                                                       |
| The obligation to minimise exposure to hoisted loads      |                                                                                                                                                                                                                                                                                                                                                       |
| The responsibility to stop when conditions become unsafe  |                                                                                                                                                                                                                                                                                                                                                       |

TABLE 5.7 — OSHA REGULATORY ALIGNMENT — CHAPTER 5

| OSHA STANDARD                             | ADDRESSED IN CHAPTER 5                                                                                                             |
|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| 1926.1425 — Keeping clear of the load     | Sections 5.1, 5.4: minimised exposure through engineered control interface and workable positioning.                               |
| 1926.1419 — Signals: general requirements | Section 5.5: communication structure, signal authority and loss-of-communication protocol.                                         |
| 1926.1418 — Authority to stop operation   | Sections 5.11, 5.12: stop conditions, stop authority and the professional obligation to recognise when guidance is not the answer. |

CONTINUED IN THE RIGGERSAFE® GUIDEBOOK

The next chapters examine specific lifting scenarios — including precision positioning, confined-space lifting and multi-crane operations — applying the practical sequence established in this chapter to more complex operational conditions.

PUBLICATION DETAILS

Chapter 5 — Publication Record

TABLE 5.8 — FIGURES AND TABLES INDEX

| REFERENCE  | TITLE                                                                                         | PAGE |
|------------|-----------------------------------------------------------------------------------------------|------|
| Figure 5.1 | The lifting operation sequence — stage overview with guidance, final approach and stop stages | 03   |
| Figure 5.2 | Final approach — seven-step sequence                                                          | 09   |
| Table 5.1  | Communication requirements during guidance                                                    | 05   |
| Table 5.2  | Observe before acting — conditions and appropriate response                                   | 06   |
| Table 5.3  | Observed conditions during guidance and appropriate responses                                 | 07   |
| Table 5.4  | Continuous positioning assessment during the lifting operation                                | 08   |
| Table 5.5  | Conditions and consequences — why stopping is the correct response                            | 10   |
| Table 5.6  | Chapter 5 in brief: what changes and what does not                                            | 12   |
| Table 5.7  | OSHA regulatory alignment — Chapter 5                                                         | 12   |

TERMINOLOGY INTRODUCED IN THIS CHAPTER

**EARO sequence** — Engage, Apply, Release, Observe. The four-step sequence for applying the minimum effective guidance input through the engineered control interface. (Section 5.8)

**Almost landed** — the condition in which a suspended load is close to its landing surface but has not yet fully transferred its weight to that surface. A load in the almost-landed condition is still a suspended load and must be treated as such. (Section 5.10)

**Stop authority** — the right, and in applicable circumstances the duty, of any member of the lifting team to issue a stop or emergency-stop signal when a safety concern is recognised. Stop authority is not limited to the crane operator or signal person. (Section 5.11, OSHA 1926.1418)

GENERAL NOTES

This chapter applies the engineering principles of Chapter 4 within the framework of established lifting regulations, industry standards and professional competency requirements. It does not supersede any applicable regulatory requirement.

OSHA references in this chapter are to 29 CFR 1926 Subpart CC. International equivalents apply in other jurisdictions.

Application should be assessed against site-specific conditions, task risk assessments and the requirements of the controlling lifting authority.

Same judgement. Better interface.

CHAPTER 5 CLOSING STATEMENT

# Chapter 6

---

## The Engineering Objectives of Suspended Load Guidance

Guiding a suspended load is not a single task. During one lifting operation, a rigger may allow the load to travel freely, make a small orientation correction, prevent contact with nearby structures, assist the final landing — or simply observe without applying any input at all. Every guidance action should have a defined purpose. Understanding those purposes is the basis for selecting the right engineered control interface for each task.

**1** Maintain Orientation

**2** Prevent Contact

**3** Position the Load

**4** Correct Rotation

**5** Final Placement

**6** Do Nothing

CHAPTER OVERVIEW

# Guidance as an Engineering Function

The previous chapter followed the lifting operation from pick-up to final placement. This chapter examines guidance itself.

Guiding a suspended load is not a single task. During one lifting operation, a rigger may allow the load to travel freely, make a small orientation correction, prevent contact with nearby structures, assist the final landing, or simply observe without applying any input. Understanding these different objectives is essential because every guidance action should have a clear purpose.

Professional riggers do not interact with suspended loads continuously. They intervene only when the lifting operation requires it, and only to the extent necessary to complete the task safely. The guidance objective determines the type of engineered control interface required, the position from which it is applied and the amount of input needed.

This chapter defines the six engineering objectives of suspended load guidance and establishes the principle that guidance is itself an engineering function — deserving the same technical consideration as the rigging arrangement that supports the load.

SECTION 6.1

## Guidance Has a Purpose

One of the most common misconceptions about suspended load guidance is that the rigger should constantly influence the load throughout the lift. In practice, experienced riggers know this is rarely necessary. Many loads travel from the lifting point to the landing area without requiring any physical intervention. The rigger observes, accompanies the operation where required, and remains ready to act if conditions change.

**Guidance begins only when the lifting operation demands it. Equally important, guidance ends when the required correction has been achieved.** Professional guidance is therefore selective rather than continuous. An intervention made without a clear objective may create movement that did not previously exist.

CHAPTER AT A GLANCE

1. Guidance has a purpose
2. The six engineering objectives of guidance
3. Guidance is not continuous
4. Professional judgement
5. Guidance is an engineering function
6. Looking ahead

CONTEXT

Chapter 6 completes the conceptual framework of the standard. Chapters 7 onwards apply this framework to specific engineered control interface types and operational scenarios.

GUIDANCE  
PRINCIPLE

PROFESSIONAL STANDARD

Every guidance action should have a defined purpose. If no guidance objective exists, observation is the correct response.

## SECTION 6.2

## The Six Engineering Objectives of Guidance

Although every lifting operation is different, most guidance activities fall into one of six practical objectives. These objectives define what the rigger is trying to achieve, not how the correction is made. Identifying the correct objective before applying the engineered control interface is the first step in selecting the right method.

### 1 MAINTAIN ORIENTATION

Some suspended loads naturally rotate as lifting begins. The objective is not to stop all movement but to maintain an orientation suitable for the next stage of the lift.

#### TYPICAL LOADS

Fabricated frames · structural members · pumps · valves · electrical panels · machine assemblies

### 2 PREVENT CONTACT

As loads travel through plants, they often pass close to structures, equipment, pipework or machinery. The objective is to maintain safe clearance. The correction required is often very small; the consequences of failing to make it may be significant.

#### TYPICAL CONTEXT

Travel through congested areas · passage close to pipework · movement near fragile equipment

### 3 POSITION THE LOAD

Occasionally the load travels correctly but needs to be moved into a specific location within the landing area — a broader objective than orientation correction alone. This may include minor directional refinement, lateral positioning or moving the load clear of a hazard before descent.

#### TYPICAL CONTEXT

Lateral movement within the landing zone · positioning over dunnage · moving clear of adjacent equipment

### 4 CORRECT ROTATION

Some loads rotate due to centre of gravity, sling arrangement, wind, crane movement or changing geometry during the lift. Small rotational corrections improve visibility, clearances and landing accuracy.

#### COMMON CAUSES OF ROTATION

Off-centre lifting points · sling twist · wind acting on a large surface · asymmetric load shape

### 5 FINAL PLACEMENT

Final placement demands the greatest rigger judgement. The load may already be correctly positioned — only a small adjustment is required before weight transfer. This is precisely where workers most instinctively reach with their hands. Hands-free guidance replaces that instinct with an engineered control interface applied, then withdrawn, before the load is fully lowered.

#### TYPICAL TASKS

Final angular correction · landing onto dunnage · orientation before lowering onto foundation

### 6 DO NOTHING

This may be the least appreciated professional skill. When a suspended load is stable, correctly oriented, travelling safely and clearing surrounding structures, no guidance is required. Experienced riggers recognise when the best correction is no correction at all.

#### PROFESSIONAL RECOGNITION

Observe. Monitor. Remain ready. Do not introduce movement that does not already exist.

TABLE 6.1 — THE SIX ENGINEERING OBJECTIVES OF GUIDANCE: SUMMARY REFERENCE

| OBJ. | ENGINEERING OBJECTIVE | WHAT THE RIGGER IS TRYING TO ACHIEVE                                                                                                                                           | WHEN IT ENDS                                                                                        |
|------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| 1    | Maintain orientation  | Keep the load in an attitude suitable for the next stage of the lift.                                                                                                          | When the required orientation is established and stable.                                            |
| 2    | Prevent contact       | Maintain safe clearance between the load and surrounding structures.                                                                                                           | When the load has cleared the hazard without contact.                                               |
| 3    | Position the load     | Move the load into a specific position within the landing area — lateral placement, path refinement or clearance from an adjacent hazard.                                      | When the load is in the required position and the path to the landing area is clear.                |
| 4    | Correct rotation      | Apply a small rotational correction to improve visibility, clearance or landing accuracy.                                                                                      | When rotation has been arrested and the load is in the required orientation.                        |
| 5    | Final placement       | Make the last adjustment required before the load is lowered onto its support. Apply the minimum effective input, then withdraw the interface before the load is fully landed. | When the load is in the required attitude and the interface has been withdrawn before full landing. |
| 6    | Do nothing            | Observe without intervening — the load is already doing what is required.                                                                                                      | When conditions change and an objective from 1–5 becomes necessary.                                 |

SECTION 6.3

Guidance Is Not Continuous

Many people imagine suspended load guidance as a continuous process — the rigger in constant contact with the load from pick-up to placement. Field observation suggests otherwise. Professional riggers constantly transition between observation and guidance. The majority of the lifting operation is often observation. Guidance occurs only when necessary.

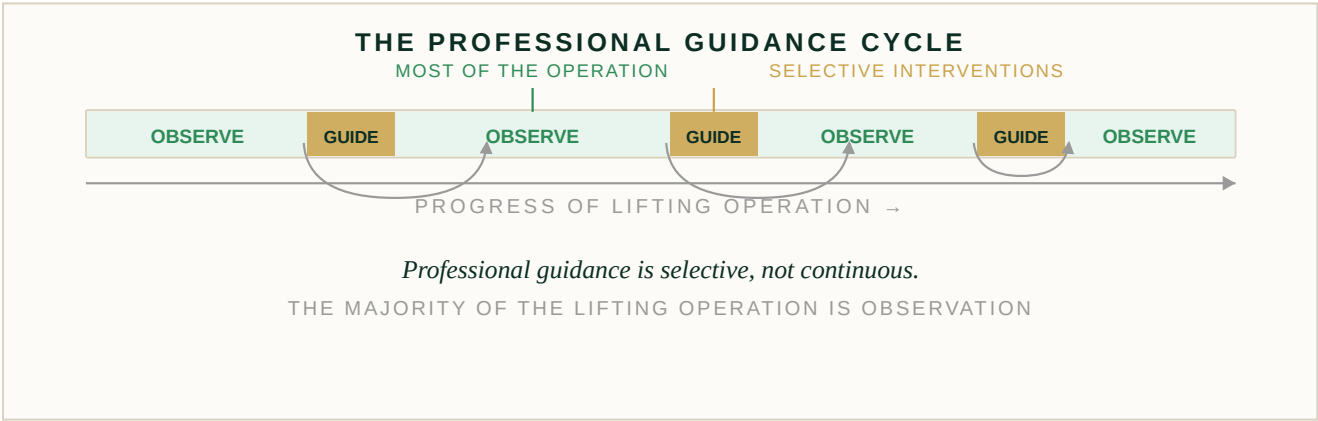


**FIGURE 6.1** — The professional guidance cycle: observation occupies the majority of the lifting operation; guidance is applied selectively when a defined objective exists. Unnecessary input between objectives can create movement that did not previously exist. This distinction reduces unnecessary intervention and prevents workers from creating movement where none existed. The guidance cycle is not a failure of attentiveness when the rigger is in the observation phase. It is professional practice.

MINIMUM EFFECTIVE INPUT

The objective is not to overpower the suspended load. It is to apply the minimum input necessary to achieve the guidance objective. Once that objective has been achieved, the input is removed and the load is observed again. A small and timely correction is almost always more controlled than a large and late one. The observation cycle begins again the moment the guidance input ends.

SECTION 6.4

Professional Judgement

Every guidance decision depends on judgement. The engineered control interface does not make these decisions. It allows them to be applied more safely.

At every moment during the lifting operation, the rigger continuously assesses whether guidance is needed and — if it is — what objective it is intended to serve. That assessment drives everything that follows: the position adopted, the interface selected, the force applied and the moment the input is removed.

THE RIGGER'S CONTINUOUS ASSESSMENT

- Does this load actually require guidance — or is it already doing what is required?
- What is the specific guidance objective? (Objectives 1–5, or Objective 6.)
- Has the previous correction achieved its purpose?
- Should I intervene now, or wait and observe?
- Should the crane operator slow, pause or stop?
- Should the operation stop completely and be reassessed?

No engineering interface replaces these decisions. It simply allows them to be applied more safely — from a position that does not require the rigger's body to become the contact point.

SECTION 6.5

Guidance Is an Engineering Function

Every lifting operation already requires engineering decisions. Riggers carefully select the correct lifting points, sling configuration, sling angles, shackle capacity, crane capacity and lifting route. Each element is chosen because it performs a specific engineering function under the loads and conditions of the task.

**Guidance deserves the same engineering consideration.** The interface through which a suspended load is guided should be selected according to the guidance objective, the characteristics of the load, the work environment and the type of movement being managed.

TABLE 6.2 — GUIDANCE AS AN ENGINEERING FUNCTION: THE PARALLEL WITH RIGGING SELECTION

| RIGGING SELECTION — ALREADY TREATED AS ENGINEERING    | GUIDANCE — SHOULD RECEIVE THE SAME TREATMENT                                 |
|-------------------------------------------------------|------------------------------------------------------------------------------|
| Sling type selected to match load geometry and weight | Interface type selected to match guidance objective and load characteristics |
| Sling angle calculated to avoid overloading           | Interface reach and working position planned before lifting begins           |
| Lifting points engineered for load balance            | Contact point on the load identified before the interface is applied         |
| Crane capacity verified for the specific lift         | Interface capacity for the expected guidance input confirmed as suitable     |
| Route planned before the lift begins                  | Guidance positions and repositioning paths planned before the lift begins    |

ENGINEERING STANDARD

Guidance is an engineered function. The interface used to guide a suspended load should be selected with the same technical care as the rigging used to lift it.

SECTION 6.6

Looking Ahead

Once the engineering objectives of guidance have been established, the next question becomes inevitable: **What type of engineered control interface is best suited to each guidance objective?**

Different interfaces behave differently. The guidance objective defines the functional requirement; the functional requirement determines the interface. That selection is the subject of Chapter 7.

The framework established in this chapter — six objectives, the observation cycle, the principle of minimum effective input and the engineering parallel with rigging selection — provides everything needed to make that selection rationally rather than by habit.

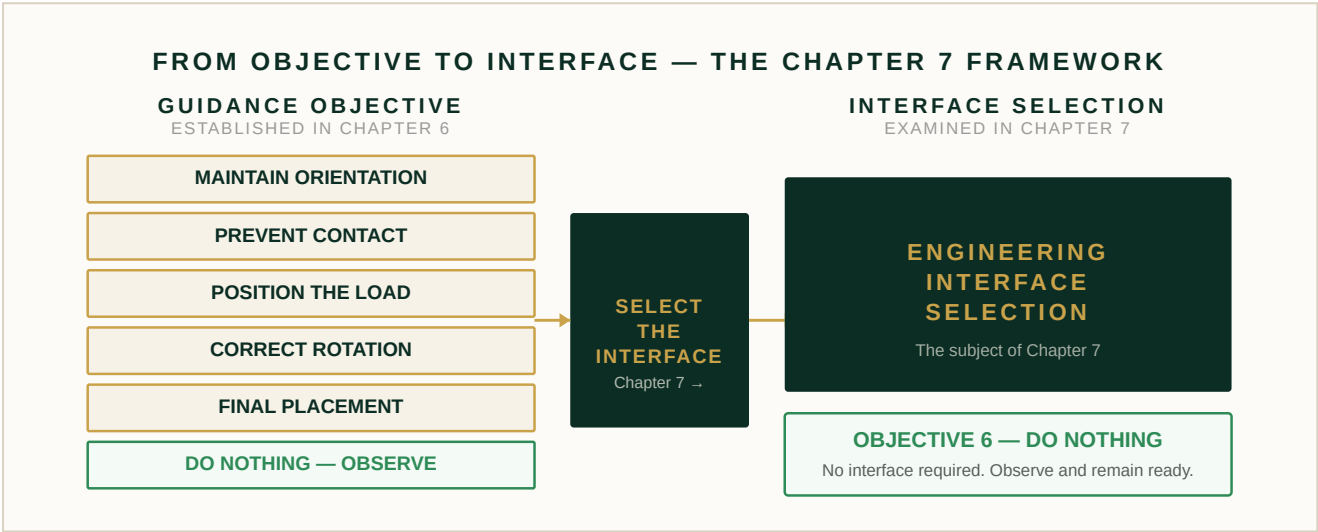


**FIGURE 6.2** — The objective-to-interface framework. Chapter 6 defines what the rigger is trying to achieve; Chapter 7 examines how to achieve it. Where Objective 6 (Do Nothing) applies, no interface is needed and observation continues.

CHAPTER 6

Summary of Key Positions

TABLE 6.3 — CHAPTER 6 IN BRIEF

| POSITION                   | STATEMENT                                                                                                                                                                                                                                                                                                               |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Guidance has a purpose     | Every guidance action should have a defined objective. If no objective exists, observation is the correct professional response. Guidance without a purpose creates risk rather than reducing it.                                                                                                                       |
| Six objectives             | All routine suspended load guidance falls into one of six engineering objectives: (1) maintain orientation; (2) prevent contact; (3) position the load; (4) correct rotation; (5) final placement; (6) do nothing and observe. Identifying the objective before acting determines the appropriate interface and method. |
| Not continuous             | Professional guidance is selective rather than continuous. The majority of most lifting operations is observation. Guidance occurs only when a defined objective exists and ends when that objective has been achieved.                                                                                                 |
| Judgement is primary       | No engineered control interface replaces the rigger's decision about whether and when to intervene. The interface provides a safer means of applying that decision — it does not make the decision itself.                                                                                                              |
| Minimum effective input    | The objective is not to overpower the load. It is to apply the minimum input necessary to achieve the guidance objective, then remove it and return to observation. A small, timely correction is more controlled than a large, late one.                                                                               |
| An engineering function    | Guidance should receive the same engineering consideration as rigging selection. The interface is chosen according to the objective, the load characteristics, the work environment and the type of movement being managed.                                                                                             |
| Objective drives selection | The guidance objective established in this chapter determines which engineered control interface is most appropriate — the question Chapter 7 addresses directly.                                                                                                                                                       |

CHAPTER 6 · DEFINING PRINCIPLE

Guidance is an engineered function. The interface used to guide a suspended load should be selected with the same technical care as the rigging used to lift it.

CONTINUED IN THE RIGGERSAFE® GUIDEBOOK

Chapter 7 applies the six engineering objectives established in this chapter to the selection of specific engineered control interfaces — examining how different interface types perform across different guidance tasks and how the appropriate selection should be made before the lift begins.

PUBLICATION DETAILS

Chapter 6 — Publication Record

TABLE 6.4 — FIGURES AND TABLES INDEX

| REFERENCE  | TITLE                                                                                            | PAGE |
|------------|--------------------------------------------------------------------------------------------------|------|
| Figure 6.1 | The professional guidance cycle — observation vs selective guidance across the lifting operation | 04   |
| Figure 6.2 | From objective to interface — the Chapter 7 framework                                            | 06   |
| Table 6.1  | The six engineering objectives of guidance — summary reference                                   | 04   |
| Table 6.2  | Guidance as an engineering function — the parallel with rigging selection                        | 05   |
| Table 6.3  | Chapter 6 in brief                                                                               | 07   |

TERMINOLOGY INTRODUCED IN THIS  
CHAPTER

**Guidance objective** — the specific engineering purpose that a guidance action is intended to achieve. One of six objectives must be identifiable before a rigger applies an engineered control interface. If no objective can be identified, the correct response is observation (Objective 6).

**Observation mode** — the professional state in which the rigger monitors the suspended load without applying guidance. Observation mode occupies the majority of most lifting operations. It is not passive — it is the active assessment of whether a guidance objective exists.

**Objective 6 (Do Nothing)** — the formal engineering recognition that no guidance input is required because the suspended load is already behaving as needed. The least appreciated and, in many operations, the most frequently appropriate of the six objectives.

SERIES POSITION

Chapter 6 completes the conceptual framework of the RiggerSafe® Guidebook. Chapters 1–3 established why guidance is needed and how loads behave. Chapters 4–5 introduced the engineering principles and their operational application. Chapter 6 defines what guidance is trying to achieve. Chapter 7 onwards applies that framework to specific interfaces and scenarios.

Application should be assessed against site-specific conditions, task risk assessments and the requirements of the controlling lifting authority.

# Chapter 7

## Selecting the Appropriate Engineered Control Interface

Chapter 6 established what guidance is trying to achieve. This chapter addresses how. Different interfaces influence suspended loads in fundamentally different ways — through tension, through rigid mechanical contact, or through a combination of both. The guidance objective determines which is appropriate. Selecting the wrong interface for the task creates engineering problems that no amount of force can resolve.

### FLEXIBLE TENSION

Travel · swing control · drift  
correction · separation maintained

### RIGID MECHANICAL

Orientation · final placement ·  
confined areas · precision  
correction

### COMBINED

Multi-stage operations · different  
objectives within one lift

CHAPTER OVERVIEW

The Reveal — Chapter 6's Unanswered Question

Chapter 6 established what guidance is trying to achieve. This chapter addresses how.

Every suspended load guidance task requires an interface between the rigger and the moving load. Throughout this guidebook we have established that guidance is an engineering function. Like every engineering function, it requires an appropriate interface selected for the demands of the specific task.

The lifting industry has long engineered how loads are lifted. Sling selection, lifting points, shackles, hooks and crane capacities are all chosen according to the demands of the lift. If we expect riggers to select the correct sling configuration and crane for a task, the guidance interface should be selected with the same technical discipline.

This chapter explains how engineered control interfaces should be selected according to the guidance objective — not by habit, availability or personal preference.

CHAPTER AT A GLANCE

- 1. Guidance is part of the lifting system
- 2. Every interface works differently
- 3. Functional categories of engineered control interfaces
- 4. Matching the interface to the guidance objective
- 5. Interface mismatch
- 6. Applying the minimum effective input
- 7. Engineering interface selection checklist
- 8. The engineering standard
- 9. Chapter summary

SECTION 7.1

Guidance Is Part of the Lifting System

Every lifting operation already consists of engineered components — crane, hook, slings, shackles, lifting points. Each has been selected because it performs a specific engineering function.

Yet when the suspended load requires guidance, the interface between the rigger and the load has often received far less engineering consideration. In many workplaces, whatever happens to be nearby is pressed into service. A rope, a length of timber, a steel bar or another improvised object becomes the means of guidance simply because it is available. Professional lifting deserves better.

ENGINEERING  
PRINCIPLE

SELECTION STANDARD

Guidance is an engineered function. The interface used to guide a suspended load should be selected with the same engineering discipline as the rigging used to lift it.

## SECTION 7.2

## Every Interface Works Differently

Not every interface influences a suspended load in the same way. Different interfaces transfer force differently — some through tension, others through compression, some through continuous restraint and others through brief, precise mechanical corrections. Understanding these differences allows the interface to match the engineering objective, rather than forcing it to perform a task for which it was never intended.

The question should never be: "What tool do we have?" The better question is: "What type of guidance does this load require?"

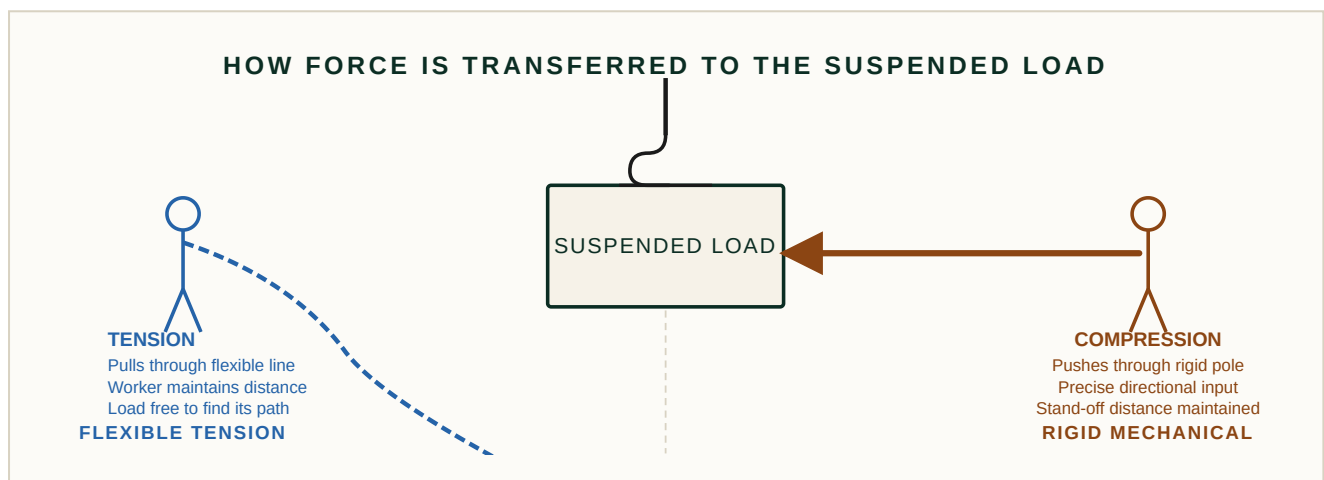


**FIGURE 7.1** — The two primary force transfer modes: flexible tension (left) influences the load through a tensile pull, maintaining natural load movement while providing directional input; rigid mechanical input (right) applies a controlled push through a rigid interface, enabling precise orientation correction from a stand-off position.

Once the force transfer mode is understood, the functional category becomes clear. The interface should be selected to match the way force must be applied to achieve the guidance objective — not selected first and then adapted to the task.

SECTION 7.3

# Functional Categories of Engineered Control Interfaces

For practical purposes, suspended load guidance interfaces can be grouped according to the way they influence the load. These categories are not product designations — they are engineering descriptions of the mechanism by which force is transferred from the rigger to the suspended load.



**CATEGORY 1**  
**Flexible Tension Interfaces**

| ENGINEERING CHARACTERISTICS                                                                                                                                                                                                                                                                                                                                                                        | TYPICAL APPLICATIONS                                                                                                                                                                                                                                                                                                                     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>• Influences the load through tension rather than compression</li><li>• Maintains practical separation over longer distances</li><li>• Reduces unwanted rotation or drift without restricting the load's natural path</li><li>• Force is applied as a pull, not a push</li><li>• Load remains free to respond to crane movement and sling geometry</li></ul> | <ul style="list-style-type: none"><li>• Long travel paths through open areas</li><li>• Outdoor lifting — wind-sensitive loads</li><li>• Large operating areas where rigid contact is not practical</li><li>• Managing drift or slow rotation during travel</li><li>• Operations where continuous but light influence is needed</li></ul> |



**CATEGORY 2**  
**Rigid Mechanical Interfaces**

| ENGINEERING CHARACTERISTICS                                                                                                                                                                                                                                                                                                                                                                                                                         | TYPICAL APPLICATIONS                                                                                                                                                                                                                                                                                                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>• Influences the load through direct mechanical contact — compression or lateral force</li><li>• Enables precise orientation changes and controlled corrections</li><li>• Effective in confined work areas where tension lines are impractical</li><li>• Suitable where the direction of force must be exactly controlled</li><li>• Interface can both push and, where appropriate, guide laterally</li></ul> | <ul style="list-style-type: none"><li>• Equipment installation and final placement</li><li>• Structural positioning and fabrication</li><li>• Machinery movement in maintenance areas</li><li>• Restricted access and confined spaces</li><li>• Operations requiring repeatable, fine positional corrections</li></ul> |



CATEGORY 3

Combined Guidance

WHEN COMBINED GUIDANCE APPLIES

- The lift has distinct stages with different guidance objectives
- A long travel phase (Objectives 1–3) transitions into a precision placement phase (Objective 5)
- The appropriate interface changes as the load moves from one environment to another

ENGINEERING POSITION

Selecting different interfaces for different stages of the same lift is not a sign of complexity — it is good engineering. The objective of each stage determines the interface appropriate to that stage.

ENGINEERING POSITION — INTERFACE NEUTRALITY

No interface is universally superior. Each interface category has engineering strengths and engineering limitations. The appropriate interface is determined by the guidance objective, the work environment and the movement that must be influenced. Treating any single interface as the universal solution to every guidance task is itself an engineering error.

SECTION 7.4

Matching the Interface to the Guidance Objective

The guidance objective should determine the interface — not the other way around. The following table connects the six objectives established in Chapter 6 to the interface category most suited to achieving them, and the engineering requirement that makes that category appropriate.

The guidance objective determines the interface. The interface should never determine the guidance objective.

TABLE 7.1 — MATCHING GUIDANCE OBJECTIVES TO INTERFACE CATEGORIES

| OBJ. | GUIDANCE OBJECTIVE   | INTERFACE CATEGORY    | ENGINEERING REQUIREMENT                                                                                                                                                            |
|------|----------------------|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | Maintain orientation | Flexible tension      | The task requires stable directional influence throughout travel; the load must remain free to find its natural path while its orientation is managed.                             |
| 2    | Prevent contact      | Flexible tension      | The task requires positive directional control at distance; minimal force must maintain safe clearance without restricting crane movement.                                         |
| 3    | Position the load    | Flexible tension or   | The task requires lateral positioning. Open environments favour flexible tension; confined approaches or precise placement favour rigid mechanical input.                          |
| 3    | Position the load    | Rigid mechanical      |                                                                                                                                                                                    |
| 4    | Correct rotation     | Rigid mechanical      | The task requires a precise rotational correction to a specific orientation; the interface must apply directional force without introducing secondary movement.                    |
| 5    | Final placement      | Rigid mechanical      | The task requires millimetre-level adjustment at the highest-exposure stage of the lift; the interface must be fully controllable and releasable before the load is fully lowered. |
| 6    | Do nothing           | No interface required | No guidance input is needed. The task requires observation only — do not introduce an interface where no guidance objective exists.                                                |

ENGINEERING NOTE

Table 7.1 is an engineering selection guide, not a product catalogue. The Engineering Requirement column describes what the task demands of the interface. Any interface that satisfies the stated requirement is an appropriate candidate for that guidance objective.

SECTION 7.5

Interface Mismatch

Engineering problems often arise when the interface does not match the task. The difficulty lies not with the suspended load but with the mismatch between the guidance objective and the selected interface.

TABLE 7.2 — COMMON INTERFACE MISMATCHES AND THEIR ENGINEERING CONSEQUENCES

| MISMATCH CONDITION                                                                 | ENGINEERING CONSEQUENCE                                                                                                                                                   |
|------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Flexible tension used where precise rotational correction is needed                | The tensile line cannot apply the directional specificity required; rotation continues or worsens.                                                                        |
| Rigid mechanical interface where the load needs to move freely through a large arc | The rigid connection resists natural load movement; the rigger may be pulled off balance.                                                                                 |
| Any interface used to compensate for incorrect rigging                             | The interface is being asked to perform a function it cannot safely achieve. Correct the rigging arrangement; do not attempt to guide a poorly rigged load into position. |
| Large force applied when only a small orientation correction is required           | Overcorrection introduces new movement; the load may swing in the opposite direction.                                                                                     |
| The same interface applied to every guidance task regardless of objective          | The interface will inevitably be unsuitable for some of the tasks it is asked to perform.                                                                                 |
| An improvised object used as the interface                                         | Load, reach, contact point, release behaviour and trapping risk are all unknown. The interface cannot be assessed before use.                                             |

ENGINEERING STANDARD

Never force an interface to perform a task for which it was not designed. When the interface is struggling, the guidance objective — or the rigging arrangement — should be reassessed before continuing.

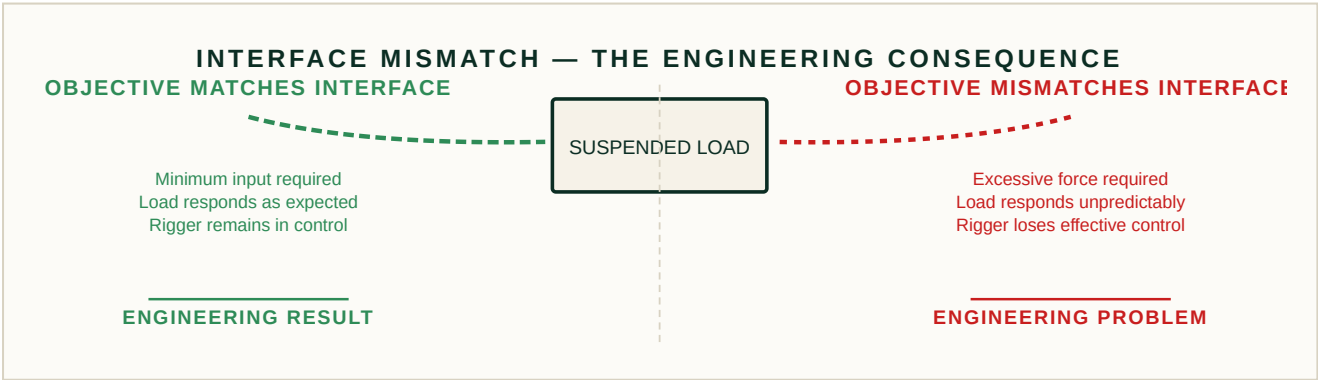


**FIGURE 7.2** — Interface match versus mismatch. When the interface is selected for the guidance objective, minimum effective input produces the expected result. When the interface mismatches the objective, increasing force does not resolve the problem — it creates a new one.

## SECTION 7.6

## Applying the Minimum Effective Input

Selecting the correct interface is only part of professional guidance. The amount of influence applied is equally important. The objective is not to overpower the suspended load — it is to apply the minimum effective input required to achieve the guidance objective. Excessive force can create unnecessary movement; repeated corrections may introduce instability rather than reduce it.

### THE PRINCIPLE

Apply only the influence required. Observe the response. Continue only if another correction is genuinely necessary.

GOOD GUIDANCE IS MEASURED BY  
PRECISION, NOT EFFORT.

### SIGNS THAT INPUT EXCEEDS THE MINIMUM REQUIRED

- The load moves further than intended after the correction.
- A second correction is needed immediately to counter the first.
- The rigger is pulling or pushing with significant sustained force.
- The interface is bending, stretching or deflecting under load.
- The load's movement is increasing rather than reducing.

## SECTION 7.7

## Engineering Interface Selection Checklist

Before guidance begins, the lifting team should address the following questions. These questions should be as routine as checking sling capacities or confirming crane ratings.

- ✓ **Guidance objective defined.** Which of the six objectives (Chapter 6) applies to this stage of the lift?
- ✓ **Movement type identified.** Is the expected movement rotation, drift, swing, tilt or directional error — or a combination?
- ✓ **Force mode matched.** Does the task require tension, compression, lateral mechanical input — or none at all?
- ✓ **Continuous or selective?** Is continuous influence needed throughout the stage, or only occasional correction?
- ✓ **Confined or open?** Will the load travel through confined areas where a flexible tension line is impractical?
- ✓ **Interface controllable throughout?** Will the interface remain manageable as the load travels and as the rigger repositions?
- ✓ **Release confirmed.** Can the interface be disengaged freely at any point without risk of becoming trapped?
- ✓ **Practical separation maintained.** Does the interface allow the rigger to remain outside the immediate contact zone while guidance is applied?
- ✓ **Selected for the task, not for availability.** Is this interface the most appropriate for the objective — not simply the nearest available object?

SECTION 7.8

# The Engineering Standard

The lifting industry has spent decades improving the engineering of cranes, lifting gear and rigging systems. Suspended load guidance deserves the same attention.

Selecting an engineered control interface should never be an afterthought. It should be an integral part of lift planning — established before the load leaves its support, just as sling selection, shackle ratings and crane capacity are established before the lift begins.

Professional riggers have always understood the importance of selecting the correct lifting equipment. The same engineering discipline now needs to be applied to selecting the correct guidance interface. The interface between the rigger and the suspended load is part of the lifting system. It deserves to be engineered accordingly.

ENGINEERING  
STANDARD

THE CENTRAL POSITION OF THIS GUIDEBOOK

The interface between the rigger and the suspended load is part of the lifting system. It should be selected with the same engineering discipline as every other component of that system — before the load leaves its support.

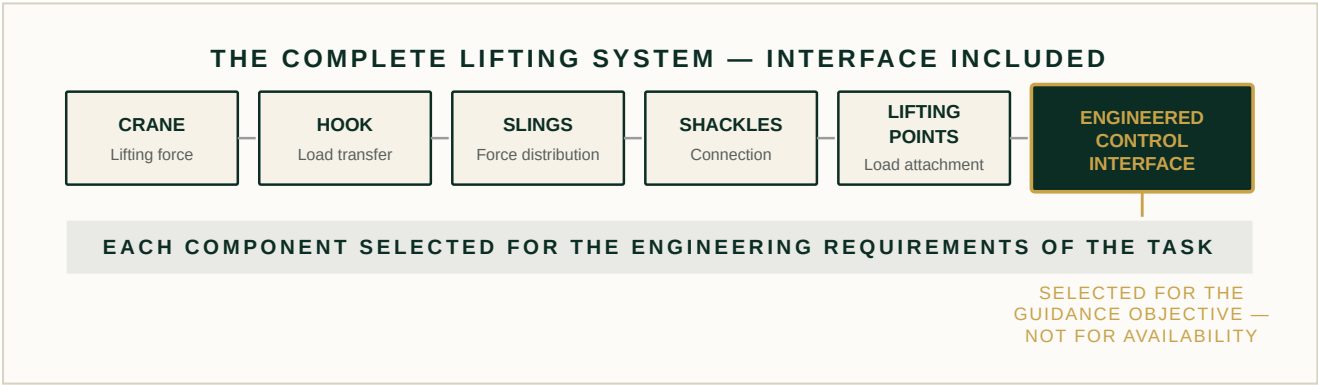


**FIGURE 7.3** — The complete lifting system. The engineered control interface is the final — and historically least engineered — component. Chapters 1–7 of this guidebook establish the basis for selecting it with the same discipline applied to every other component in the system.

CHAPTER 7

Chapter Summary

TABLE 7.3 — CHAPTER 7 IN BRIEF

| POSITION                                | STATEMENT                                                                                                                                                                                                                                                      |
|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Part of the lifting system              | The engineered control interface is a component of the lifting system and should receive the same engineering consideration as the crane, slings and shackles.                                                                                                 |
| Different interfaces, different effects | Flexible tension interfaces influence the load through a tensile pull, maintaining natural movement while providing directional input. Rigid mechanical interfaces apply precise compression or lateral force for orientation corrections and final placement. |
| Three functional categories             | Flexible tension (travel, drift, swing control); rigid mechanical (orientation, confined areas, final placement); combined (multi-stage operations with different objectives at different stages).                                                             |
| Objective drives selection              | The guidance objective (Chapter 6) determines the engineering characteristic required. The engineering characteristic determines the appropriate interface category.                                                                                           |
| Mismatch creates problems               | When the interface does not match the objective, increasing force does not resolve the problem — it creates a new one. Reassess the objective or the rigging arrangement before continuing.                                                                    |
| Minimum effective input                 | The correct interface, correctly used, requires the minimum effective input to achieve the guidance objective. Excessive force is a sign of mismatch, not of inadequate effort.                                                                                |
| Before the load leaves the ground       | Interface selection should be completed as part of lift planning — not improvised when guidance becomes necessary.                                                                                                                                             |

LOOKING AHEAD — CHAPTER 8

Chapters 1–7 have established the engineering foundation: why guidance is needed, how loads behave, the principles and objectives of hands-free guidance, and the framework for selecting the appropriate interface. Chapter 8 introduces the RiggerSafe® rigid engineered control interface, explains the engineering philosophy behind its design, and demonstrates how it satisfies the interface-selection framework established throughout this guidebook.

PUBLICATION DETAILS

Chapter 7 — Publication Record

TABLE 7.4 — FIGURES AND TABLES INDEX

| REFERENCE  | TITLE                                                                            | PAGE |
|------------|----------------------------------------------------------------------------------|------|
| Figure 7.1 | How force is transferred — flexible tension vs rigid mechanical input compared   | 03   |
| Figure 7.2 | Interface match versus mismatch — engineering consequence diagram                | 06   |
| Figure 7.3 | The complete lifting system — engineered control interface as a system component | 08   |
| Table 7.1  | Matching guidance objectives to interface categories                             | 05   |
| Table 7.2  | Common interface mismatches and their engineering consequences                   | 06   |
| Table 7.3  | Chapter 7 in brief                                                               | 09   |

TERMINOLOGY INTRODUCED IN THIS CHAPTER

**Flexible tension interface** — an engineered control interface that influences the suspended load through a tensile pull. The load remains free to respond to crane movement and sling geometry; the interface provides directional input without rigid mechanical connection between the rigger and the load.

**Rigid mechanical interface** — an engineered control interface that influences the suspended load through direct mechanical contact, applying compression or lateral force to achieve precise orientation corrections or final placement adjustments.

**Combined guidance** — the use of more than one interface category within a single lifting operation, where different stages have different guidance objectives requiring different force transfer modes.

**Interface mismatch** — the condition in which the selected engineered control interface is unsuitable for the guidance objective it is being asked to achieve. Interface mismatch is most commonly identified by the need to apply excessive or repeated force to achieve a result that should require minimum effective input.

SERIES POSITION

Chapter 7 completes the engineering framework of the RiggerSafe® Guidebook — the seven-chapter sequence from understanding human behaviour (Ch 2) and load physics (Ch 3) through engineering principles (Ch 4), operational application (Ch 5), guidance objectives (Ch 6) and interface selection (Ch 7).

Chapter 8 introduces the RiggerSafe® rigid engineered control interface, explains the engineering philosophy behind its design, and demonstrates how it satisfies the selection framework established here.

Application should be assessed against site-specific conditions, task risk assessments and the requirements of the controlling lifting authority.

# Chapter 8

---

## The Evolution of RiggerSafe®

### *Engineering the Interface*

Chapters 1–7 established why guidance is an engineering function, how loads behave, the principles of hands-free guidance, the objectives guidance serves, and the framework for selecting the appropriate interface. This chapter answers the question that framework naturally raises: what does an interface designed specifically to satisfy those requirements look like — and how did it come to exist?

Industrial products are not perfected in laboratories.  
They mature through repeated observation in the environments for which they are designed.

ENGINEERING POSITION · SECTION 8.2

CHAPTER OVERVIEW

The Question Seven Chapters Raised

Throughout this guidebook we have established one central engineering principle: professional riggers should not need to use their bodies as the primary interface for guiding suspended loads.

That principle naturally raises a further question. If the body is no longer the interface, what should replace it?

This chapter explains how more than a decade of industrial experience, engineering refinement and field validation led to the development of the RiggerSafe® rigid engineered control interface. It is not a story about inventing a new lifting method. It is the story of engineering a better way for professional riggers to apply the judgement and skills they have always possessed.

Every significant feature of the RiggerSafe® interface exists because it solved an engineering problem repeatedly observed during real industrial lifting operations.

CHAPTER AT A GLANCE

1. Engineering begins with the problem
2. Learning from the field
3. One geometry, multiple industrial tasks
4. Engineering the complete assembly
5. Engineering for the rigger
6. The crane carries the load
7. Engineering is often learning what doesn't work
8. Why the range expanded
9. Engineering for different industrial environments
10. Engineering through continuous improvement
11. The ten design principles

SECTION 8.1

Engineering Begins with the Problem

Industrial lifting has never lacked skilled riggers. What has often been missing is an engineered interface through which those skills can be applied safely. For decades, suspended loads have been guided using hands, shoulders, feet, timber, pipes, improvised bars and whatever else happened to be available at the worksite.

The problem was never that riggers lacked judgement. The problem was that the only available interface was frequently the human body itself.

ENGINEERING OBJECTIVE

THE DESIGN BRIEF

Preserve the rigger's judgement. Replace only the physical interface. The challenge was not to redesign lifting — it was to redesign how the rigger interacts with the suspended load.

## SECTION 8.2

## Learning from the Field

The first PSC LoadGuider® tools were introduced in 2014. Their purpose was straightforward: provide industrial workers with a rigid stand-off interface that allowed suspended loads to be guided without direct body contact. Like every industrial product, the first generation answered some questions while raising many more.

Laboratory testing can simulate certain conditions. Real industrial environments cannot. Every lifting operation introduced different combinations of load geometry, confined spaces, vibration, impact, operator technique, weather, maintenance conditions and unexpected movement. Rather than treating field observations as isolated incidents, each one became an engineering lesson.

2014

### FIRST GENERATION — LOADGUIDER®

Initial rigid stand-off interface introduced. Core objective: provide industrial riggers with a practical alternative to direct body contact during suspended load guidance. First field deployments across steel, fabrication and offshore sectors.

—

### FIELD VALIDATION — ENGINEERING REFINEMENT

Each deployment produced engineering observations across durability, ergonomics, handling, interface geometry and real-load behaviour. Refinements addressed repeated patterns rather than isolated incidents.

—

### MULTIPLE LENGTHS — CONFIGURATION RANGE

Additional lengths introduced to provide operators with practical choices for different working situations. Selection principle: the interface that provides sufficient separation while remaining comfortable and controllable for the task.

Now

### RIGGERSAFE® — ACCUMULATED FIELD KNOWLEDGE

The result of more than a decade of continuous engineering refinement based on real industrial experience across multiple industries and countries. One head geometry, nine available lengths, and assembly validation on the complete working interface.

#### ENGINEERING POSITION

Industrial products are not perfected in laboratories. They mature through repeated observation in the environments for which they are designed. The evolution from the original LoadGuider® platform to RiggerSafe® reflects this process — not a redesign, but an accumulation of engineering lessons from thousands of real suspended-load guidance tasks.

Every refinement began with a field observation.

## SECTION 8.3

## One Geometry. Multiple Industrial Tasks.

One of the earliest engineering objectives was to avoid creating different heads for different industries.

Instead, the goal was to develop one practical geometry capable of interacting with the wide variety of industrial loads encountered during routine lifting operations. Different areas of the interface profile naturally support different forms of interaction — allowing the same head to assist with pushing, pulling, steadying and positional correction while remaining mechanically simple.

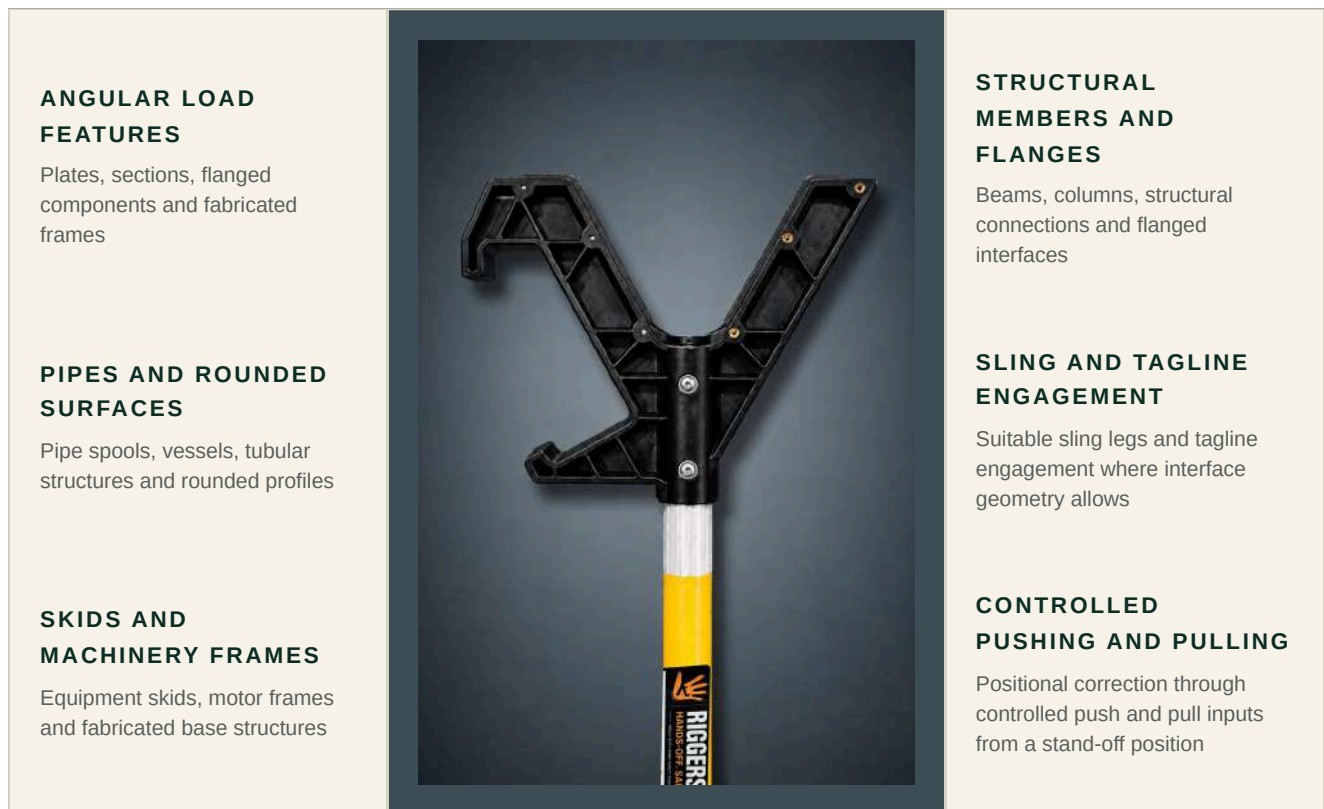


**FIGURE 8.1** — One head geometry, multiple industrial applications. The RiggerSafe® profile provides functional contact areas for controlled pushing, pulling and positional correction across common angular, rounded and framed industrial load forms without requiring interchangeable attachments.

Its purpose is not to perform every task. Its purpose is to perform the vast majority of routine suspended-load guidance tasks using one robust industrial interface — reducing complexity and maintaining the mechanical simplicity that industrial service demands.

## SECTION 8.4

## Engineering the Complete Assembly

A guidance interface should never be judged by one component alone.

When a rigger applies force during suspended-load guidance, that force travels through the complete assembly. The head. The shaft. The central support. The lower handle. The operator. Every part contributes to the structural performance of the interface.

Industrial guidance introduces more than simple pushing and pulling. The interface must tolerate repeated changes in loading direction, twisting, vibration, impact, off-axis loading and the shock associated with real lifting operations.

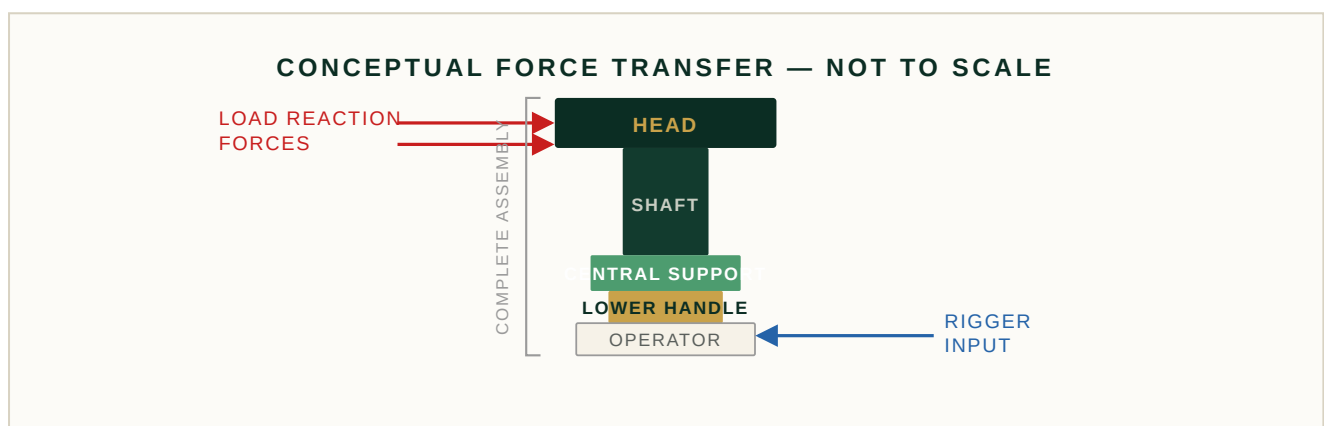


**FIGURE 8.2** — Conceptual force-transfer diagram (not to scale; does not represent actual component dimensions or construction). When a rigger applies guidance input, forces pass through the complete assembly from contact point to operator. Engineering development addressed the behaviour of the entire interface under these conditions — not individual components in isolation.

### ASSEMBLY VALIDATION — INDEPENDENT TESTING ON THE COMPLETE INTERFACE

The completed RiggerSafe® assembly was independently evaluated as a complete working interface rather than as separate components — reflecting the engineering philosophy that industrial performance depends upon the behaviour of the entire interface under real operating conditions.

**300 kg** Push testing — conducted on the complete assembly under push loading conditions representative of industrial guidance tasks.

**150 kg** Pull testing — conducted on the complete assembly under tensile loading conditions representative of industrial guidance tasks.

Engineering did not replace experience. It listened to it.

SECTION 8.5

Engineering for the Rigger

Every engineering decision ultimately serves one person: the professional rigger. Engineering becomes an exercise in balance — between length and controllability, between strength and weight, between separation and manageability.

TABLE 8.1 — ENGINEERING BALANCE IN THE RIGGERSAFE® INTERFACE

| ENGINEERING PARAMETER | IF TOO FAR IN ONE DIRECTION                                      | IF TOO FAR IN THE OTHER                                                  |
|-----------------------|------------------------------------------------------------------|--------------------------------------------------------------------------|
| Weight / mass         | Too heavy → increased operator fatigue; reduced precision        | Too light → insufficient confidence in demanding conditions              |
| Length                | Too short → reduced practical separation from the suspended load | Too long → reduced controllability; increased moment arm on the operator |
| Grip security         | Too slippery → loss of control under impact or vibration         | Too rough → abrasion; impaired repositioning                             |
| Head geometry         | Too narrow → limited contact surface for pushing                 | Too wide → reduced access in confined areas                              |

Longer interfaces naturally increase the distance between the rigger and the suspended load — and also increase the moment arm acting on the operator. For this reason, longer interfaces are intended to be used with both hands, allowing the rigger to maintain stable footing, controlled posture and accurate guidance throughout the operation.

SECTION 8.6

The Crane Carries the Load

One of the most common misunderstandings surrounding guidance interfaces is the assumption that they somehow support the suspended load. They do not.

The crane supports 100 percent of the suspended mass. The guidance interface supports none of the vertical weight. Its purpose is simply to allow the rigger to influence orientation, direction and position.

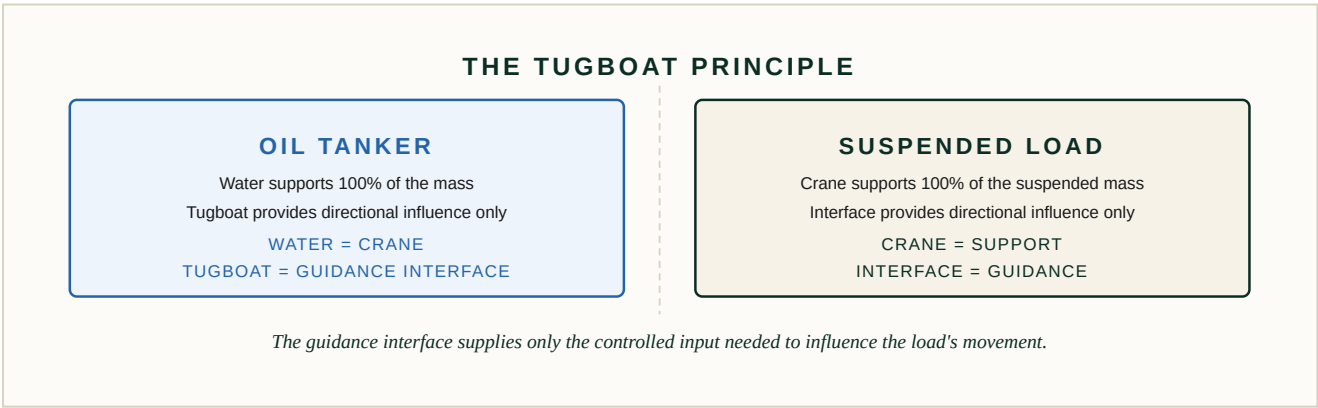


FIGURE 8.3 — The tugboat principle. A tugboat does not carry the weight of an oil tanker; the water supports the tanker while the tugboat provides controlled directional influence. Suspended-load guidance works in the same way: the crane supports the load; the guidance interface supplies only the input needed to influence its movement.

## ENGINEERING HISTORY

## Engineering Is Often Learning What Doesn't Work

Not every engineering lesson arrives through a successful test. Some of the most important lessons arrive through field observation of what begins to fail — and why.

During the early years of field deployment, the interface performed well under the push and pull forces typical of routine guidance tasks. Operators valued the stand-off distance it provided. The engineering principle — separate the rigger from the load while preserving control — was confirmed in practice.

However, industrial lifting operations introduce forces that are difficult to fully anticipate in development. Suspended loads swing. They contact structures unexpectedly. Operators occasionally use the interface in ways that concentrate load through one region of the assembly rather than distributing it across the complete structure.

Over time, field observations identified durability limitations under repeated industrial shock loading — conditions where sudden off-axis forces were applied to a limited area of the interface geometry. The problem was not catastrophic failure. It was the gradual accumulation of fatigue in regions where stress concentration was highest.

The field does not care about design intent. It applies the forces that the work demands.

Reinforcement trials were conducted. Some improved performance. None eliminated the problem entirely. Each trial produced engineering data that clarified the underlying mechanism — concentrated load was the issue, not the magnitude of force alone.

The conclusion was straightforward. The interface required redesigning so that force was distributed more effectively across the complete assembly rather than concentrated through a single region. Subsequent generations of the interface incorporated this learning directly into the structural geometry.

### ENGINEERING POSITION

The engineering value of a field observation is not the incident itself. It is the opportunity to understand a loading condition that the development environment did not fully replicate — and to apply that understanding to the next generation of the product.

This process — observe, analyse, redesign, validate, deploy — is the engineering cycle that distinguishes a product that has genuinely matured in industrial service from one that has simply been manufactured for long enough. The LoadGuider® platform taught these lessons. RiggerSafe® was designed with them already incorporated.

SECTION 8.7

## Why the Range Expanded

The original PSC LoadGuider® range followed established industrial dimensions — 21", 42", 50", 72" and 96". These lengths reflected the proportions that industrial practice had already shown to be useful for a wide range of lifting operations.

After years of field deployment across multiple industries, engineers repeatedly encountered the same practical difficulty. Operators found themselves choosing between an interface that was slightly too short for the separation the task required, and one that was unnecessarily long and increased the moment acting on the operator without a corresponding engineering benefit.

The issue was not convenience. It was engineering.

Longer interfaces increase practical separation — but they also increase the rotational moment acting on the operator. Shorter interfaces improve precision and ease of handling — but they reduce the distance between the rigger and the suspended load. The original range did not always provide a length that optimised both considerations for the specific task.

To address this, a complementary range in foot-based dimensions was introduced:

|                                    |                                    |                                    |
|------------------------------------|------------------------------------|------------------------------------|
| <div>2 ft</div> <div>610 MM</div>  | <div>3 ft</div> <div>915 MM</div>  | <div>4 ft</div> <div>1220 MM</div> |
| <div>5 ft</div> <div>1524 MM</div> | <div>6 ft</div> <div>1829 MM</div> | <div>8 ft</div> <div>2438 MM</div> |

Industrial Blue was initially used to distinguish these foot-based lengths from the original inch-based range, making selection easier on site and reducing the risk of confusion between related but dimensionally distinct tools.

The objective was never to encourage the use of longer interfaces. The objective was to ensure that when the engineering assessment established the required separation for a specific task, the appropriate length was available. A length that had previously been either absent or required an uncomfortable compromise.

ENGINEERING POSITION

*The range provides the options. The lifting assessment determines which option is appropriate.*

LOOKING AHEAD · CHAPTER 9

Selecting a RiggerSafe® length does not begin with a size chart. It begins by understanding the fall zone, the movement envelope, landing hazards, practical working position and required separation.

Only after those engineering considerations have been established should the appropriate interface length be selected. Chapter 9 examines these engineering principles before any recommendations are made regarding interface length.

SECTION 8.8

Engineering for Different Industrial Environments

Suspended-load guidance tasks are not performed in uniform conditions. Industrial environments vary significantly — in temperature, surface condition, contamination, atmospheric exposure and operational intensity. Engineering the interface for the environment is as important as engineering it for the load.

TABLE 8.2 — RIGGERSAFE® CONFIGURATIONS BY OPERATING ENVIRONMENT

| CONFIGURATION                   | ENGINEERING PURPOSE                                                                                                                                                                                                                                                                                                     | IMPORTANT LIMITATIONS                                                                                                                                                                                                                                                                                                                               |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Standard configuration          | General industrial service. Head geometry with rubber contact insert for grip and load protection. Suitable for the majority of routine industrial lifting environments.                                                                                                                                                | Not suitable for sustained exposure to elevated temperatures or highly abrasive contact surfaces.                                                                                                                                                                                                                                                   |
| Aluminium-contact configuration | Developed primarily because some applications — particularly those involving rough mill scale, abrasive fabrication surfaces or highly textured industrial components — rapidly abrade the rubber contact insert in the standard configuration. The aluminium contact surface is significantly more abrasion-resistant. | This is <i>not</i> an extreme-temperature version. Very high temperatures — including applications near blast furnaces, molten metal environments or sustained radiant heat — still exceed the capability of the head assembly. Users should not interpret the aluminium contact surface as extending the thermal operating range of the interface. |
| Non-conductive fibreglass shaft | Provides an additional degree of electrical separation between the operator and the load in environments where incidental contact with energised equipment is a concern.                                                                                                                                                | RiggerSafe® should not presently be represented as certified electrical protective equipment until formal dielectric testing has been completed. The fibreglass shaft provides separation — it does not constitute a tested or certified electrical insulation system.                                                                              |
| Rubber inserts                  | Load protection and grip enhancement in environments where surface marking must be minimised.                                                                                                                                                                                                                           | Subject to accelerated wear in abrasive environments. See aluminium-contact configuration.                                                                                                                                                                                                                                                          |

ENGINEERING NOTE — EXTREME ENVIRONMENTS

Field deployments near blast furnaces, very high-temperature casting operations and similar extreme environments ultimately required interface concepts beyond the capability of the current head assembly. This operational learning contributed to the development of alternative PSC guidance interfaces — including PSC Load-it® — designed specifically for environments in which the RiggerSafe® platform is not appropriate.

Selection of the correct interface for the operating environment is an engineering decision, not a procurement convenience. If the operating conditions are uncertain, consult the manufacturer before deployment.

THE INTERFACE MUST NEVER BE USED TO

- Support or carry any portion of the suspended load's vertical weight.
- Act as a pry bar, lever or extraction tool.
- Arrest or decelerate a falling or rapidly moving load.
- Substitute for correct crane movement or rigging adjustment.
- Compensate for an incorrectly balanced or improperly rigged load.

SECTION 8.9

Engineering Through Continuous Improvement

No industrial product is ever truly finished. Every new application teaches something. Every new environment presents different challenges. Every deployment provides another opportunity to learn.

The product evolved because the work kept teaching us.

The evolution from the original LoadGuider® platform to RiggerSafe® reflects more than a decade of continuous engineering refinement based on real industrial experience across multiple industries and countries. The result is not simply another guidance tool. It is the accumulated knowledge gained from thousands of real suspended-load guidance tasks performed by professional riggers.

ENGINEERING POSITION

Development does not end with a product launch. It continues with every deployment, every new environment and every rigger who applies the interface to a task its developers had not specifically anticipated. Field knowledge is the most rigorous form of engineering validation.

CHAPTER 8

Chapter Summary

TABLE 8.3 — CHAPTER 8 IN BRIEF

| POSITION                   | STATEMENT                                                                                                                                                                                                          |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The engineering brief      | Preserve the rigger's judgement. Replace only the physical interface through which that judgement is applied.                                                                                                      |
| Field as the laboratory    | The LoadGuider® platform, introduced in 2014, matured into RiggerSafe® through more than a decade of field observation and engineering refinement — not through redesign for its own sake.                         |
| One geometry               | One head design, applicable across the range of industrial load forms encountered in routine operations. Mechanical simplicity serves industrial service better than interchangeable attachments.                  |
| The complete assembly      | Engineering focused on the complete structural system — validated at 300 kg push and 150 kg pull on the full assembly — because industrial performance depends on the entire interface, not individual components. |
| The crane carries the load | The guidance interface supports none of the vertical weight. It provides only the controlled input needed to influence the load's orientation, direction and position.                                             |
| The professional rigger    | Professional riggers have always guided suspended loads through experience, judgement and skill. RiggerSafe® changes only the interface through which those qualities are applied.                                 |

The crane continues to carry the load. The rigger continues to make the decisions. The body is simply no longer the interface through which those decisions are applied.

CHAPTER 8 · CLOSING STATEMENT

## THE TEN DESIGN PRINCIPLES BEHIND RIGGERSAFE®

These are not product features. They are the engineering positions that governed every decision made during the development of the RiggerSafe® rigid engineered control interface.

**1****RESPECT THE RIGGER BEFORE REDESIGNING THE INTERFACE.**

The rigger's experience, judgement and skill are not the problem. They are the starting point.

**2****FIELD EXPERIENCE IS THE MOST DEMANDING ENGINEERING LABORATORY.**

Controlled conditions simulate. Real industrial environments test.

**3****ONE GEOMETRY SHOULD SOLVE MANY INDUSTRIAL TASKS.**

Mechanical simplicity serves industrial service better than interchangeable attachments.

**4****ENGINEER THE COMPLETE ASSEMBLY — NOT ISOLATED COMPONENTS.**

Industrial performance depends on the behaviour of the entire interface under real operating conditions.

**5****GREATER SEPARATION SHOULD NEVER REDUCE CONTROLLABILITY.**

Length increases practical separation. It must not compromise the rigger's ability to maintain precise, controlled guidance.

**6****INDUSTRIAL ROBUSTNESS MUST COEXIST WITH PRACTICAL ERGONOMICS.**

An interface too heavy to use correctly provides no engineering benefit, regardless of its structural strength.

**7****SELECT THE INTERFACE TO SUIT THE TASK — NOT THE TASK TO SUIT THE INTERFACE.**

The guidance objective determines the interface. An interface should never constrain how a lift is planned.

**8****THE CRANE SUPPORTS THE MASS. THE INTERFACE GUIDES THE MOVEMENT.**

The guidance interface supports none of the vertical load. Confusing these two functions is an engineering error.

**9****EVERY REFINEMENT MUST SOLVE A REAL INDUSTRIAL PROBLEM.**

Refinement for its own sake adds complexity without adding value. Every change must be traceable to a field observation.

**10****THE HIGHEST ACHIEVEMENT OF AN ENGINEERED INTERFACE IS THAT IT BECOMES A NATURAL EXTENSION OF THE RIGGER'S JUDGEMENT.**

When the interface disappears from the rigger's awareness and the guidance task simply gets done — the engineering has succeeded.

RiggerSafe® was not created to change how professional riggers think. It was created to improve the interface through which they apply what they already know.

PUBLICATION DETAILS

Chapter 8 — Publication Record

TABLE 8.4 — FIGURES AND TABLES INDEX

| REFERENCE  | TITLE                                                    | PAGE |
|------------|----------------------------------------------------------|------|
| Figure 8.1 | One head geometry — multiple industrial load forms       | 04   |
| Figure 8.2 | Force travels through the complete assembly              | 05   |
| Figure 8.3 | The tugboat principle — crane supports, interface guides | 06   |
| Table 8.1  | Engineering balance in the RiggerSafe® interface         | 06   |
| Table 8.2  | RiggerSafe® configurations by operating environment      | 09   |
| Table 8.3  | Chapter 8 in brief                                       | 10   |
| Table 8.4  | Figures and tables index (this table)                    | 12   |

KEY TERMS IN THIS CHAPTER

**RiggerSafe® rigid engineered control interface** — the purpose-engineered rigid mechanical guidance interface developed by PSC Hand Safety. One head geometry, available in nine lengths. Independently validated as a complete assembly at 300 kg push and 150 kg pull.

**LoadGuider®** — the original PSC rigid stand-off guidance interface introduced in 2014, from which RiggerSafe® evolved through more than a decade of field observation and engineering refinement.

**Complete assembly** — the total structural system of the interface: head, shaft, central support, lower handle, and the connection between them. Engineering development and validation focused on the complete assembly rather than individual components, because industrial guidance performance depends on the behaviour of the entire interface.

GENERAL NOTES

The RiggerSafe® interface should be used in accordance with the manufacturer's instructions, the lifting plan and the applicable regulations and site procedures for the operation. It does not replace any lifting standard or statutory requirement.

The assembly validation figures quoted in this chapter (300 kg push, 150 kg pull) were conducted on the complete RiggerSafe® assembly. They describe test conditions and do not constitute operational load limits or warranty claims. Consult the current manufacturer's documentation for product specifications.

The RiggerSafe® Guidebook. Published by PSC Hand Safety India Private Limited. RiggerSafe® is a PSC Hand Safety Brand.

# Chapter 9

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## Engineering the Space Around a Suspended Load

### *Fall Zones, Movement Envelopes and Practical Separation*

Before an interface can be selected, the space around the lift must be engineered. This chapter teaches readers to think spatially about suspended loads — to see not just where the load is, but the engineered volume of space it could reasonably occupy, and to use that understanding to determine where a rigger should stand before any guidance method is chosen.

The hazard is the space the load could reasonably occupy — not merely the space it occupies now.

The lift determines the distance. The distance determines the interface.

Professional riggers engineer the space before they engineer the control.

## CHAPTER OVERVIEW

## Engineering the Space

Every suspended load occupies two different spaces. The first is the space it occupies at this moment. The second is the space it could reasonably occupy if the lift does not proceed exactly as intended.

Professional lifting teams plan for the second. Throughout this guidebook, guidance has been treated as an engineering function rather than a behavioural task. The same philosophy now applies to the working space itself. Before deciding how a suspended load will be guided — or which interface will be used — the lifting team must first understand the physical space that the load may occupy throughout the operation.

This chapter introduces the systematic assessment of hazard boundaries, movement envelopes and practical worker positioning before any guidance method is selected.

## SECTION 9.1

## Engineering the Space

Every lift creates a temporary working environment. Unlike a permanent machine guard or a fixed walkway, that environment changes continuously as the load rises, travels, rotates and approaches its destination. The engineering challenge is not simply identifying where the load is — it is anticipating where the load could reasonably be.

A stationary suspended load presents one hazard profile. A swinging load presents another. A rotating load presents another. A load approaching a structural member presents yet another. The worker's position should be determined by the complete hazard space rather than the load's instantaneous position.

The hazard is the space the load could reasonably occupy — not merely the space it occupies now.

## CHAPTER AT A GLANCE

1. Engineering the space
2. Understanding the hazard boundaries
3. Every load has its own movement envelope
4. Establishing practical separation
5. When the load is beyond rigid reach
6. Transition between interfaces
7. Engineering the decision sequence

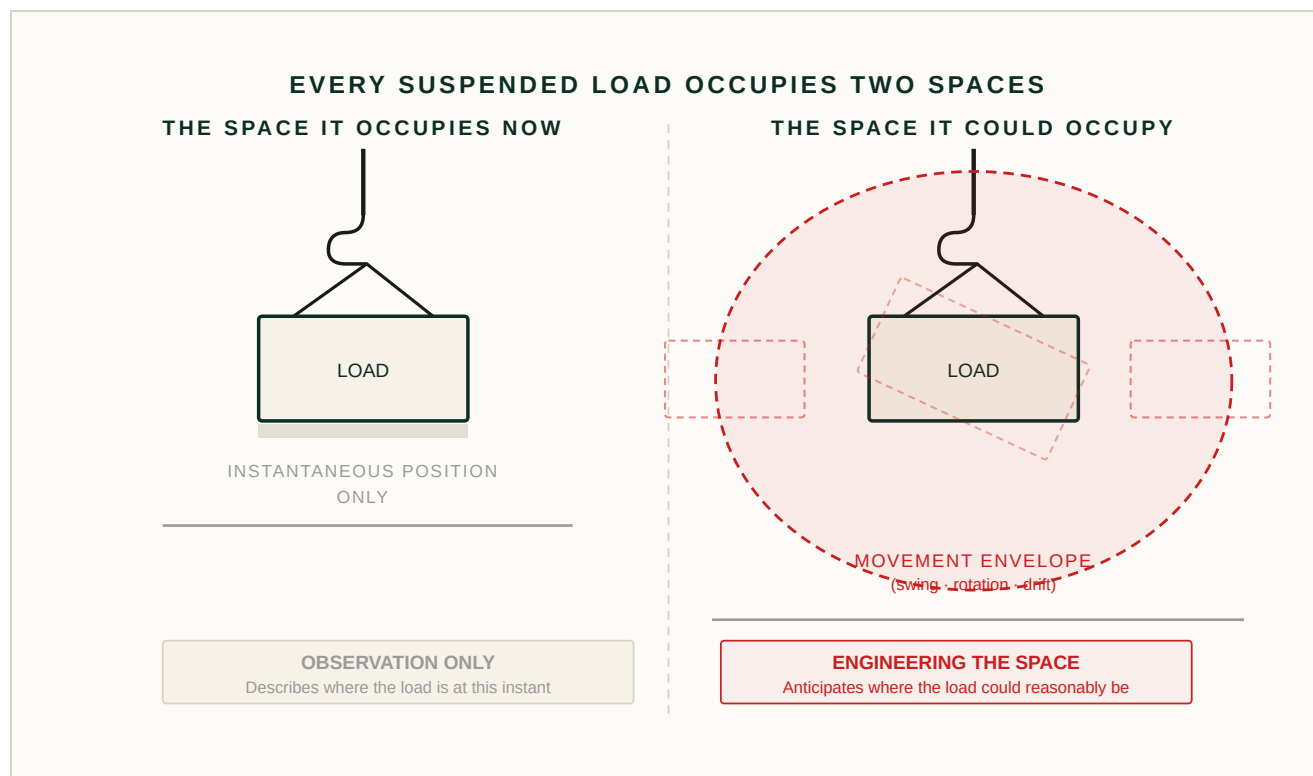


**FIGURE 9.1** — Every suspended load occupies two spaces. Professional lifting teams plan for the second. The movement envelope — not the instantaneous position — defines the hazard space that must be engineered before any guidance method is selected.

## SECTION 9.2

### Understanding the Hazard Boundaries

Safe lifting requires more than identifying the area directly beneath the hook. Several distinct hazard boundaries exist simultaneously throughout a lifting operation. Each requires a different engineering response.

## SECTION 9.2 — CONTINUED

## The Five Hazard Boundaries

### FZ THE FALL ZONE

*The area where suspended material could reasonably be expected to fall if the lifting system experiences an unintended failure or loss of control.*

**Engineering implication:** Never assume the fall zone is limited to the exact footprint beneath the load. Movement already present in the system may cause the load or detached components to land away from the vertical centreline. Regulatory requirements govern access; personnel exposure must be minimised except where essential to the operation.

**Two distinct conditions — different risks:**

*Dropped load (failure):* Catastrophic release of the suspended mass. Exclusion is the only engineering response.

*Controlled suspended load (normal operation):* The crane is functioning correctly. The hazards are swing, rotation, pinch and closing — not free fall. This distinction is what makes guidance tasks near a suspended load possible and necessary even though workers must never stand beneath it.

### ME THE MOVEMENT ENVELOPE

*The total volume of space the suspended load could reasonably occupy due to planned crane movement, residual swing, rotation, wind, inertia, changes in centre of gravity or contact with surrounding structures.*

**Engineering implication:** Unlike the fall zone, the movement envelope changes continuously throughout the lift. Engineering the movement envelope requires anticipation rather than observation — it must be assessed before the lift begins and reassessed as conditions change.

### LF THE LANDING FOOTPRINT

*The area where the load is intended to be permanently supported at the completion of the lift.*

**Engineering implication:** Although the load is approaching the end of the lift, this phase often presents the highest concentration of direct body contact risk. Workers naturally move closer to verify alignment. Many suspended-load hand injuries occur during this stage — not because the lift fails, but because proximity becomes the assumed requirement to complete the task.

### CH THE CLOSING HAZARD

*The shrinking gap created as a suspended load approaches another object — a structure, machine, dunnage, vehicle, adjacent load, foundation or process equipment.*

**Engineering implication:** The mechanism is rarely a falling load. Injuries occur when a suspended mass continues moving toward a fixed structure, trapping a hand, arm or body between two rigid surfaces. The closing hazard exists wherever a suspended load and a fixed object converge.

### ENGINEERING NOTE — SEPARATION AND INTERFACE SELECTION

Practical separation does not always mean using a rigid interface. Where the required separation exceeds the effective reach of a rigid interface, a flexible tension interface — a tagline — becomes the appropriate engineering solution. The tagline transmits control through tension from a distance; the rigid interface applies precise mechanical input at close working range.

Interface selection is addressed later in this guidebook. At this stage, the objective is simply to understand that different methods exist to suit different separation requirements. The engineering principle is the same in both cases: guidance is maintained; direct body contact is not.

ENGINEERING INSIGHT — THE LOAD HAS NO INTENT: ONLY PHYSICS

Workers often describe incidents by saying: *"The load suddenly came towards me."* The load possesses no intent. It simply responds to gravity, inertia, sling geometry, centre of gravity, external forces and momentum.

Understanding this distinction encourages anticipation rather than reaction. A load that appears stable is not choosing to remain still — it is momentarily in equilibrium. Any change in the forces acting on it will produce movement.

Professional riggers read physics. They do not negotiate with it.

SECTION 9.3

Every Load Has Its Own Movement Envelope

No two suspended loads behave identically. Weight alone does not determine hazard. A compact machinery base, a long structural beam, a pipe bundle and a thin steel plate may all weigh five tonnes — yet their movement characteristics are entirely different.

FACTORS THAT ENLARGE THE MOVEMENT ENVELOPE

|                                                                                                                           |                                                                                                                      |                                                                                                              |
|---------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| <b>SUSPENDED HEIGHT</b><br>Greater height → longer pendulum → wider swing arc                                             | <b>LOAD GEOMETRY</b><br>Long loads sweep wide arcs; flat loads act as sails                                          | <b>CENTRE OF GRAVITY</b><br>Off-centre CoG drives unexpected tilt or rotation during lift                    |
| <b>SLING ARRANGEMENT</b><br>Sling leg angles and pick point positions affect settling and rotation                        | <b>WIND</b><br>Acts on exposed surfaces; particularly significant with flat loads and outdoor lifts                  | <b>CRANE ACCELERATION</b><br>Sudden starts, stops or direction changes introduce swing that persists         |
| <b>VESSEL OR PLATFORM MOTION</b><br>Any movement of the supporting structure is transmitted through the crane to the load | <b>NEARBY ROTATING MACHINERY</b><br>Vibration transmitted through structure can disturb a hanging load unpredictably | <b>CONTACT WITH STRUCTURES</b><br>Snagging or glancing contact can deflect the load or release stored energy |

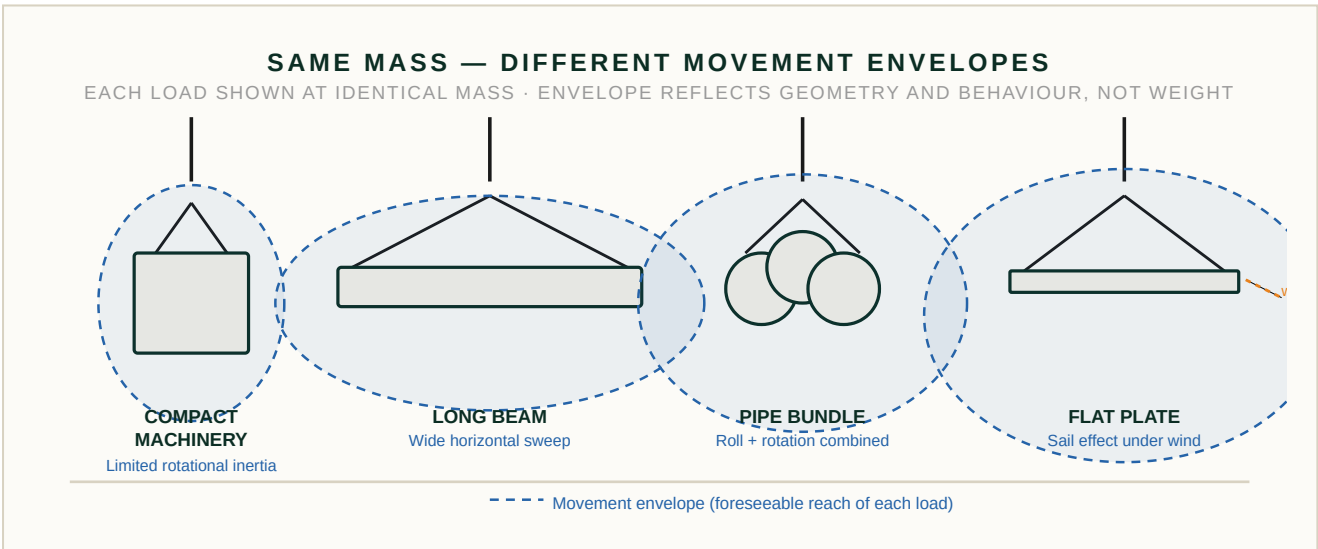


FIGURE 9.2 — Four loads at identical mass, four different movement envelopes. Load geometry determines hazard space more significantly than mass alone. Professional riggers evaluate geometry and behaviour as carefully as they evaluate weight.

Every suspended load has its own movement envelope.

SECTION 9.4

Establishing Practical Separation

There is no universal safe distance applicable to every suspended load.

The required separation depends on load geometry, suspended height, foreseeable movement, environmental conditions, rigging arrangement, available working space and the chosen guidance method. These factors must be assessed for each specific task before any guidance method is selected.

TABLE 9.1 — FACTORS THAT DETERMINE THE REQUIRED PRACTICAL SEPARATION

| FACTOR                   | ENGINEERING CONSIDERATION                                                                                                              |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| Load geometry            | Long loads sweep wider arcs. Large flat surfaces are more susceptible to wind. Asymmetric loads may rotate unexpectedly after lifting. |
| Suspended height         | Greater suspended height increases the potential swing arc and the energy stored in any pendulum motion.                               |
| Foreseeable movement     | Rotation, drift and swing that can be anticipated from the rigging arrangement, centre of gravity or operating environment.            |
| Environmental conditions | Wind, vessel or platform motion, vibration and nearby moving equipment all affect the movement envelope.                               |
| Available working space  | Confined areas may limit the practical working position and require a different guidance approach.                                     |
| Guidance method          | The selected interface determines how much separation can be maintained while guidance remains effective.                              |

**FIELD PLANNING HEURISTICS**

Field teams sometimes use rules of thumb as preliminary planning aids. Such heuristics may assist early discussions but should never replace the lift plan, competent judgement, task-specific risk assessment or applicable site procedures.

Rules of thumb describe past practice. They do not constitute engineering assessment for the specific task.

**RIGGERSAFE® ENGINEERING GUIDANCE — DETERMINING THE PRACTICAL WORKING POSITION**

When planning a guidance task, establish the practical working position before selecting the interface. Ask:

- Where could the load reasonably move throughout this operation?
- Where are the closing hazards?
- Where can the rigger maintain visibility of the load and destination?
- Where is a clear escape route available?
- Can effective guidance be performed from this position?

Only after these questions have been answered should an interface be selected.

**CHAPTER 9 · DOCTRINE STATEMENT**

The objective is never to eliminate guidance. The objective is to eliminate unnecessary exposure during guidance.

Guidance remains an engineering function throughout this guidebook. Separation engineering does not remove the rigger from the operation — it positions the rigger where guidance can be applied safely.

**THE WORKING POSITION IS DYNAMIC, NOT STATIC**

Practical working position is not a marked spot on the floor. As the load travels, the rigger moves with the operation — maintaining the same engineering relationship to the load throughout.

This is the principle established in Chapter 5 and carried forward here: *accompany the operation — not the footprint of the suspended load*. The rigger does not stand still and wait for the load to arrive. The rigger moves continuously with the lift, preserving visibility, escape route and the required separation at every stage.

The lift determines the distance. The distance determines the interface.

SECTION 9.5

# When the Load Is Beyond Rigid Reach

Not every suspended load can be reached using a rigid push/pull interface. As the required separation increases, the rigid interface that provides precise directional input at close range becomes impractical. The engineering response is not to move the worker closer — it is to change the interface.

### RIGID INTERFACE

- Controlled push and pull
- Precise directional input
- Fixed stand-off distance
- Final positioning and orientation
- Effective at close working range

### FLEXIBLE TENSION INTERFACE (TAGLINE)

- Transmits tension only — cannot push
- Long reach; maintains separation
- Swing and rotation management
- Gross orientation during transit
- Less precise as distance increases

ENGINEERING  
PRINCIPLE

### INTERFACE CHANGE — NOT POSITION CHANGE

When the required separation exceeds the practical reach of a rigid interface, change the interface — not the separation.

SECTION 9.6

# Transition Between Interfaces

Many lifting operations require more than one interface. Long-distance control may begin with a flexible tension interface. As the load enters the practical working envelope of the rigger, control transitions to a rigid engineered interface for final positioning. This transition should be planned before the lift begins — never improvised during the landing phase.

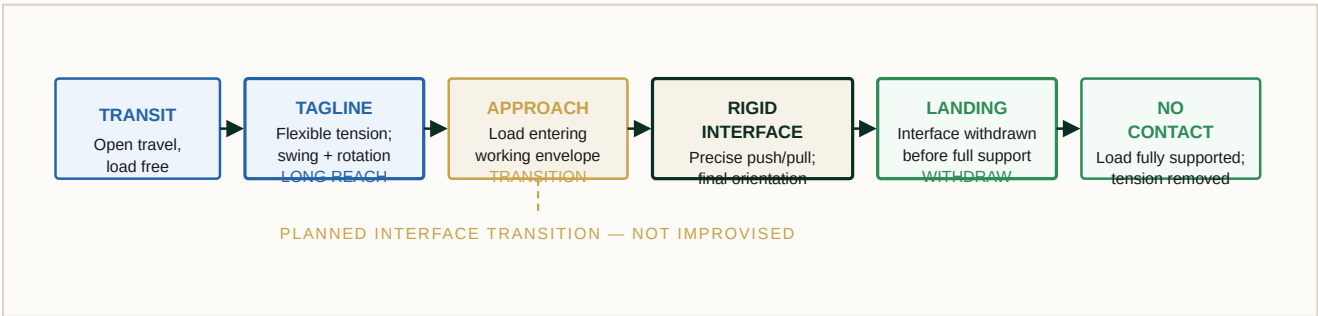


**FIGURE 9.3** — The interface transition sequence across a complete lifting operation. The transition from flexible tension to rigid mechanical interface should be planned before the lift begins.

## SECTION 9.7

## Engineering the Decision Sequence

The sequence of engineering decisions matters as much as the decisions themselves. Selecting an interface before understanding the required separation is no different from selecting rigging before determining the load. Reversing the sequence creates unnecessary compromise.

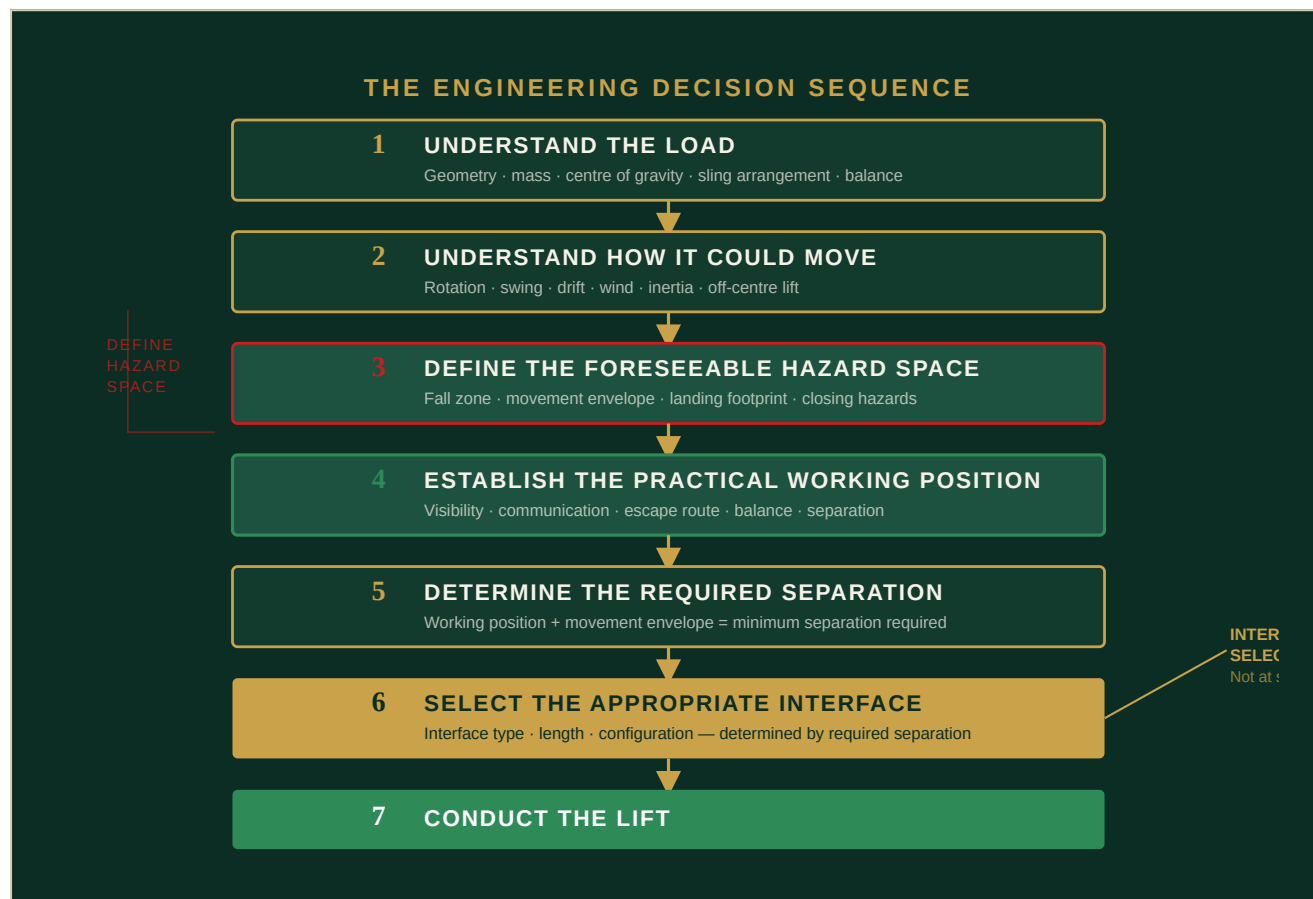


**FIGURE 9.4** — The engineering decision sequence. The interface is selected at step 6 — after the load, its movement, the hazard space, the working position and the required separation have all been established. Reversing this sequence forces a compromise that engineering assessment would otherwise prevent.

CHAPTER 9

## Chapter Summary

Safe distance is not a fixed number. It is the outcome of engineering judgement applied to a specific lifting task. The objective is not simply to keep workers away from suspended loads — it is to position them where they can safely observe, communicate and apply guidance without unnecessary exposure.

TABLE 9.2 — CHAPTER 9 IN BRIEF

| CONCEPT                                | ENGINEERING POSITION                                                                                                                                                                        |
|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Two spaces                             | Every suspended load occupies the space it is in now and the space it could reasonably occupy. Professional lifting teams engineer the second.                                              |
| Five hazard boundaries                 | Fall zone, movement envelope, landing footprint, closing hazard and practical working position each require a distinct engineering response. They exist simultaneously throughout the lift. |
| Load geometry matters                  | Identical masses can produce completely different movement envelopes depending on geometry. A long beam sweeps a far wider arc than a compact machine at the same weight.                   |
| No universal distance                  | Required separation depends on geometry, height, foreseeable movement, environment, rigging and available workspace. It must be assessed for each task — not read from a generic table.     |
| Physics, not intent                    | Suspended loads respond to gravity, inertia, sling geometry and momentum. Professional riggers anticipate this — they do not wait to react to it.                                           |
| Interface follows position             | The practical working position determines the required separation. The required separation determines the appropriate interface. This sequence must not be reversed.                        |
| Change the interface, not the position | When the required separation exceeds the reach of a rigid interface, the appropriate response is to use a flexible tension interface — not to move the worker closer to the load.           |

Professional riggers engineer the space before they engineer the control.

LOOKING AHEAD · CHAPTER 10

The working position determines the required separation. The required separation determines the interface. Chapter 10 begins with a practical engineering question:

*If this is the separation the task demands — how long should the interface actually be?*

PUBLICATION DETAILS

Chapter 9 — Publication Record

TABLE 9.3 — FIGURES AND TABLES INDEX

| REFERENCE  | TITLE                                                                                  | PAGE |
|------------|----------------------------------------------------------------------------------------|------|
| Figure 9.1 | Every suspended load occupies two spaces — instantaneous position vs movement envelope | 03   |
| Figure 9.2 | Same mass, different movement envelopes — four load types compared                     | 05   |
| Figure 9.3 | The interface transition sequence across a complete lifting operation                  | 07   |
| Figure 9.4 | The engineering decision sequence — seven steps to interface selection                 | 08   |
| Table 9.1  | Factors that determine the required practical separation                               | 06   |
| Table 9.2  | Chapter 9 in brief                                                                     | 09   |
| Table 9.3  | Figures and tables index (this table)                                                  | 10   |

TERMINOLOGY INTRODUCED IN THIS  
CHAPTER

**Fall zone** — the area where suspended material could reasonably be expected to fall if the lifting system experiences an unintended failure or loss of control. Regulatory requirements govern access to this area.

**Movement envelope** — the total volume of space a suspended load could reasonably occupy due to planned crane movement, residual swing, rotation, wind, inertia, changes in centre of gravity or contact with surrounding structures.

**Landing footprint** — the area where the load is intended to be permanently supported at the completion of the lift.

**Closing hazard** — the shrinking gap created as a suspended load approaches another object, creating a trapping risk between two rigid surfaces.

**Practical working position** — the location from which the rigger can observe the load, communicate, maintain balance, preserve an escape route and apply guidance only when required. The starting point for all guidance planning.

GENERAL NOTES

This chapter addresses the engineering principles of spatial assessment for suspended load guidance. It does not prescribe universal separation distances or replace site-specific risk assessment, applicable regulations or the lifting plan.

Where regulatory concepts such as the fall zone are referenced, these are described in general engineering terms. The applicable regulatory requirement will vary by jurisdiction, industry and site. Consult the relevant regulation and the controlling lifting authority for the requirements that apply to the specific operation.

RiggerSafe® Engineering Guidance is clearly distinguished from regulatory requirements throughout this chapter. The two must not be confused.

# Chapter 10

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## Selecting the Appropriate RiggerSafe® Interface

### *Translating Engineering Requirements into Practical Selection*

Eight chapters of engineering reasoning have established why guidance is necessary, how loads behave, and where personnel should stand. This chapter translates those requirements into a selection framework — and places the reader in front of the product range they have been thinking about since Chapter 1.

The interface is selected only after the engineering requirements of the lift have been understood.

CHAPTER OVERVIEW

Interface Selection as Engineering Consequence

Throughout this guidebook, the reader has followed a progressive engineering sequence — from understanding hand exposure, to establishing guidance as an engineering function, to mapping the hazard space around a suspended load.

Only now does the selection of the guidance interface become appropriate. This sequence is deliberate. Selecting an interface before understanding the engineering requirements of the task is no different from selecting a sling before knowing the weight of the load. The interface is the consequence of engineering judgement — not the starting point.

CHAPTER AT A GLANCE

1. The interface is selected last
2. Engineering variables that drive selection
3. Selecting working length
4. When does a tagline become better?
5. One head — multiple applications
6. Why engineering matters
7. Material selection
8. Understanding load control forces
9. Colour system
10. Practical care
11. Summary

SECTION 10.1

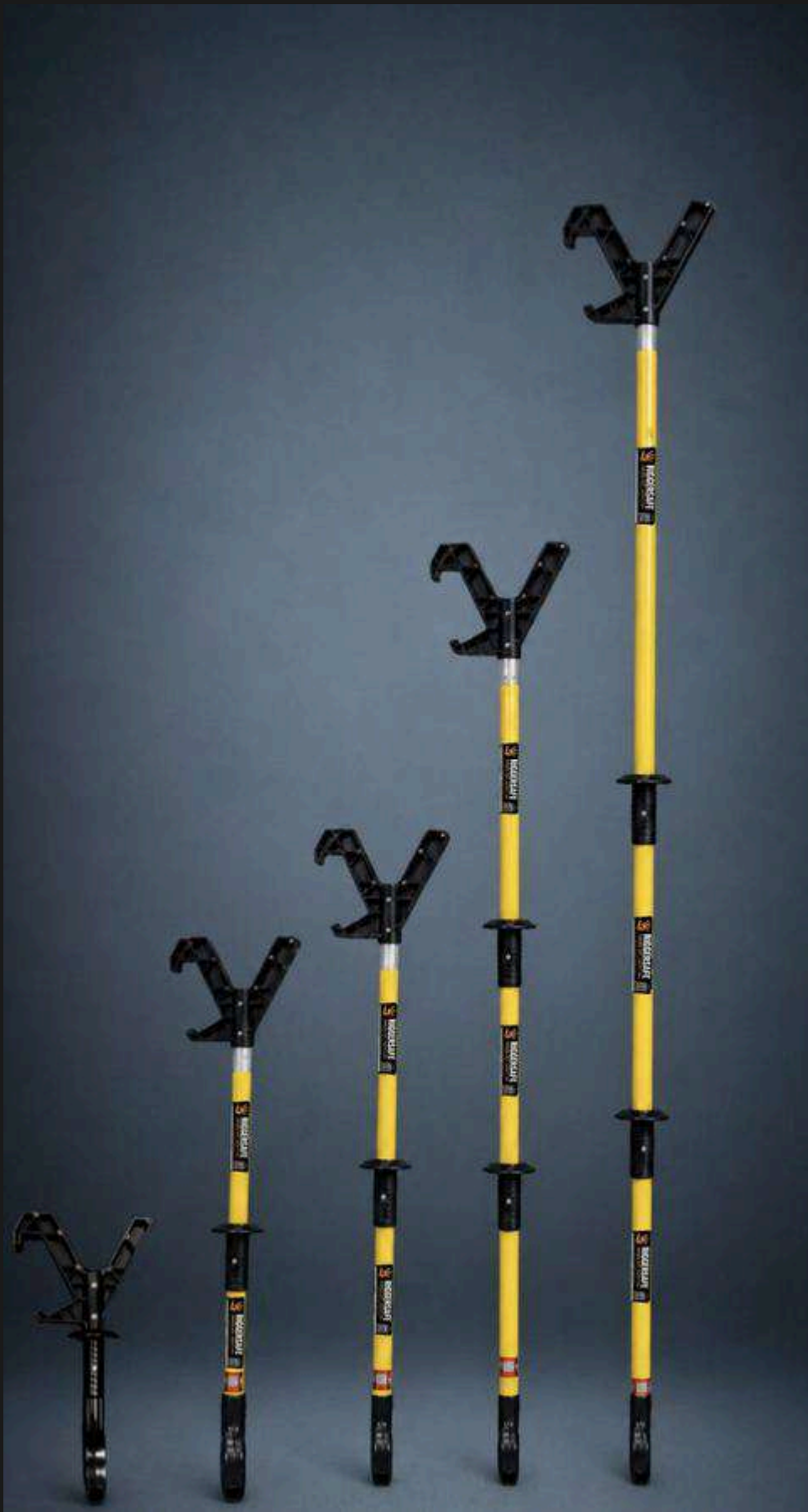
The Interface Is Selected Last

Professional lifting teams do not begin by asking: *"Which tool should we use?"* They begin by asking what the load is, how it can move, where personnel should stand, how much separation is required and what guidance objective must be achieved. Only then can an appropriate interface be selected.

ENGINEERING PRINCIPLE

POSITION BEFORE INTERFACE

The interface should never determine the working position. The required working position should determine the interface.



## THE STANDARD RIGGERSAFE® WORKING LENGTHS

21 in · 42 in · 50 in · 72 in · 96 in · 2 ft · 3 ft · 4 ft · 5 ft · 6 ft · 8 ft

*Working length is selected from the required operator separation established during lift planning — not from personal preference.*

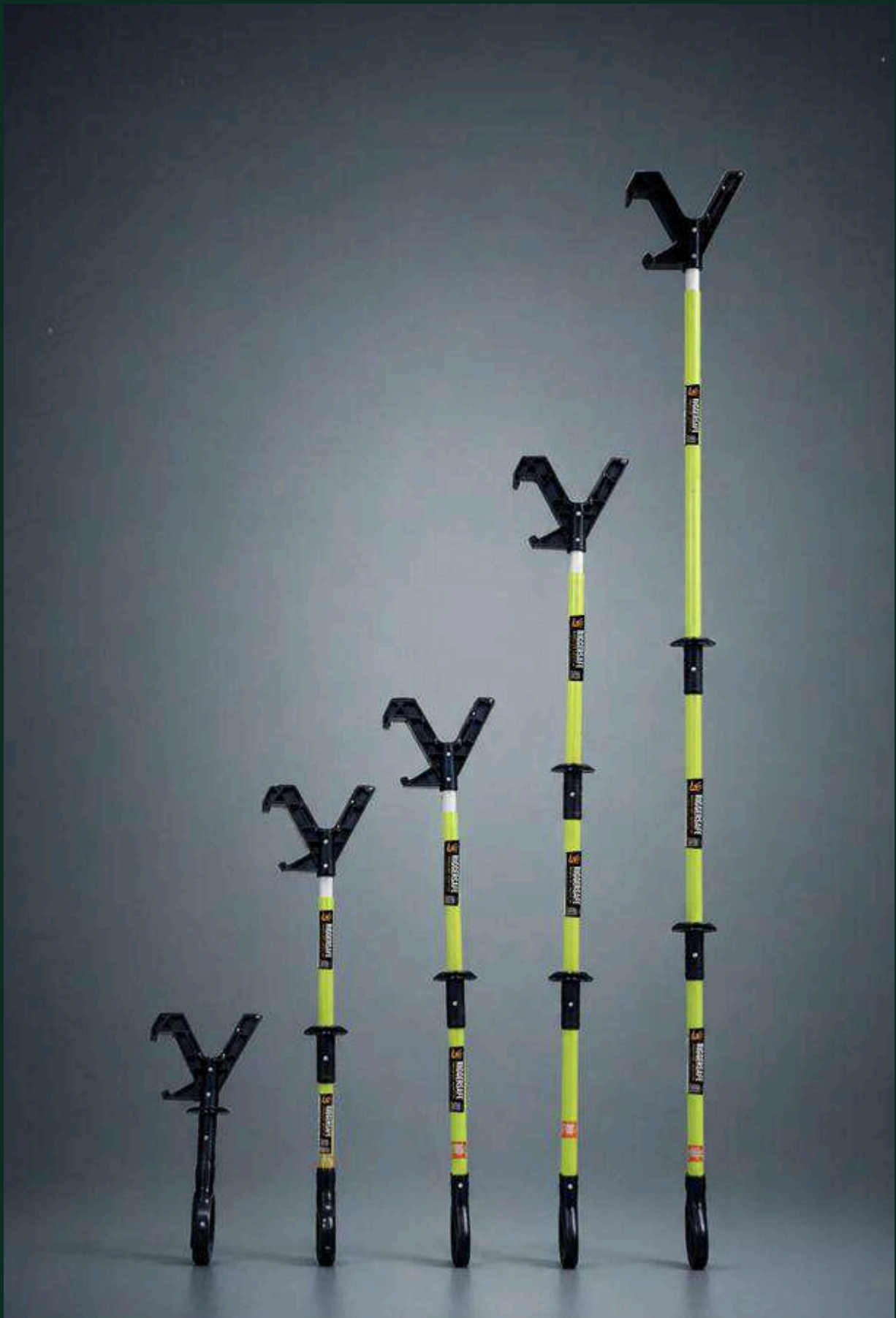
SECTION 10.2

# The Engineering Variables That Drive Selection

Before any interface length or type can be specified, the engineering conditions of the task must be understood. Ten variables govern selection.

|                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>REQUIRED SEPARATION</b></p> <p>The minimum distance between the worker and the suspended load, established by the practical working position from Chapter 9.</p>                                                  | <p><b>LOAD GEOMETRY</b></p> <p>Large surfaces, overhanging sections or irregular profiles may prevent close approach and require greater stand-off independent of the movement envelope.</p>                                                              |
| <p><b>PRECISION REQUIRED</b></p> <p>Final alignment in confined spaces requires fine control. Longer interfaces reduce the precision of small positional corrections at the load.</p>                                   | <p><b>AVAILABLE WORKING SPACE</b></p> <p>Confined areas limit body movement and may constrain the effective usable length of a long interface regardless of the separation requirement.</p>                                                               |
| <p><b>LOAD HEIGHT</b></p> <p>Suspended height determines swing arc potential. Greater height typically demands greater horizontal separation to remain outside the movement envelope.</p>                               | <p><b>LANDING ENVIRONMENT</b></p> <p>The closing hazard is highest during landing. Load height above the footprint and proximity of fixed structures affect the required working position.</p>                                                            |
| <p><b>SURFACE CONDITION</b></p> <p>Highly abrasive surfaces accelerate wear on standard rubber contact inserts and may require the aluminium contact configuration.</p>                                                 | <p><b>TEMPERATURE</b></p> <p>Elevated temperatures affect insert wear rate and polymer dimensional stability. Extreme environments may exceed assembly capability — see Section 10.7.</p>                                                                 |
| <p><b>ELECTRICAL EXPOSURE</b></p> <p>Where incidental contact with energised equipment is possible, a non-conductive fibreglass shaft provides separation. Not currently certified electrical protective equipment.</p> | <p><b>RIGID OR FLEXIBLE INTERFACE?</b></p> <p>If required separation exceeds the practical reach of a rigid interface, a flexible tension interface — tagline — becomes the appropriate engineering solution. Section 10.4 addresses this transition.</p> |

Engineering improves when the interface fits the task — not when the task adapts to the interface.



## NEON GREEN — HIGH-VISIBILITY RANGE

21 in · 42 in · 50 in · 72 in · 96 in

*Colour is a specification choice, not a different product. The engineering selection criteria are identical across all colour variants.*

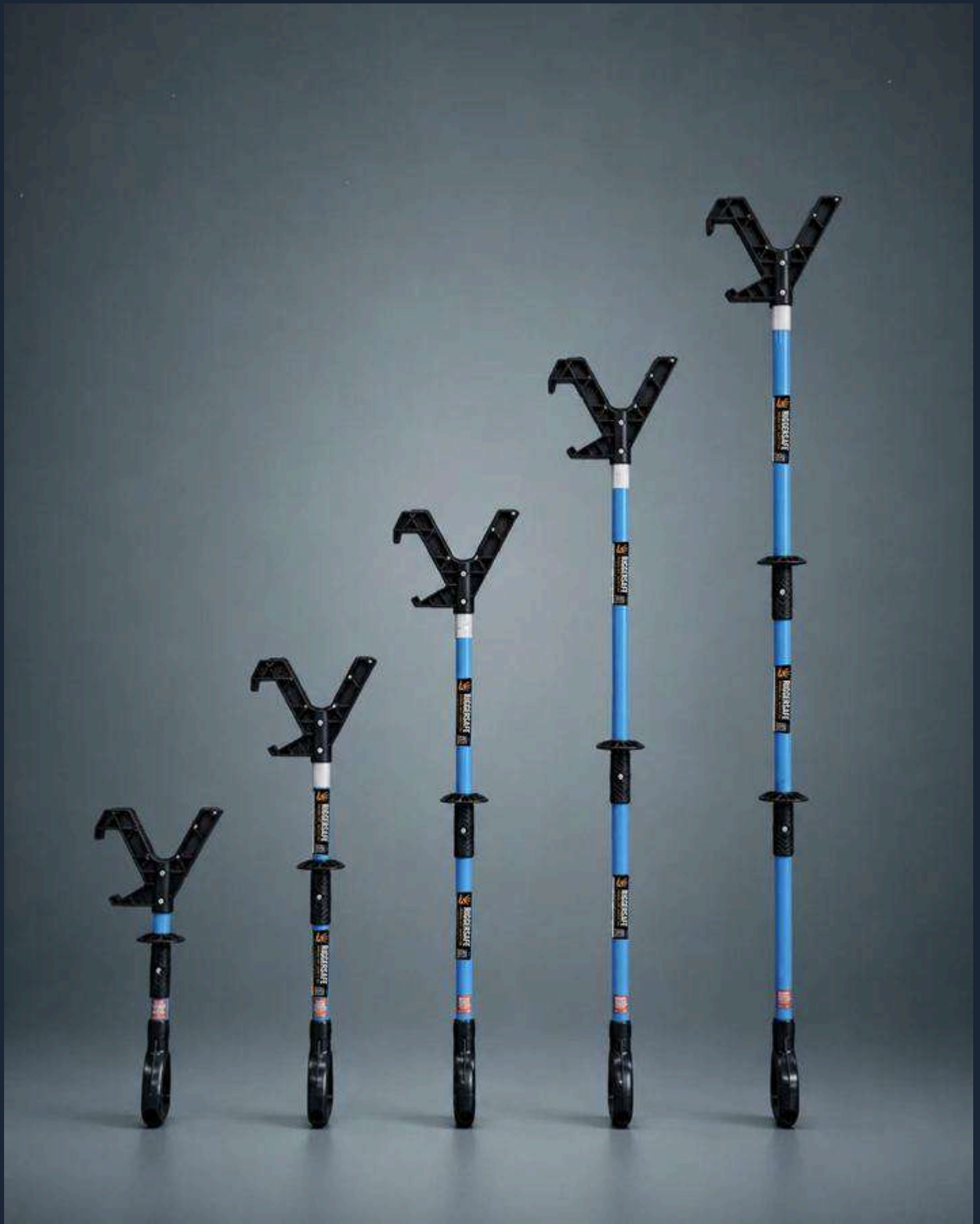
SECTION 10.3

Selecting Working Length

Each length in the range represents a distinct engineering position — a deliberate response to the working distances that industrial practice has repeatedly shown to be necessary. The range was expanded not to provide more options, but to eliminate the engineering compromise of choosing between a tool that is too short and one that is unnecessarily long.

TABLE 10.1 — WORKING LENGTHS: ENGINEERING PURPOSE AND TYPICAL APPLICATION

| LENGTH          | ENGINEERING PURPOSE                                | TYPICAL APPLICATION                                                                   |
|-----------------|----------------------------------------------------|---------------------------------------------------------------------------------------|
| 21 in / 535 mm  | Close-quarters precision; minimum stand-off        | Maintenance inside machinery, confined enclosures, final alignment in tight access    |
| 2 ft / 610 mm   | Short stand-off with improved ergonomics           | Precision positioning, confined plant areas, assembly work at bench height            |
| 3 ft / 915 mm   | Moderate separation for light fabrication          | Fabrication benches, general maintenance, light industrial assembly                   |
| 42 in / 1067 mm | Standard separation for general industrial lifting | Broad-range industrial use; the classic general-purpose working length                |
| 4 ft / 1220 mm  | Intermediate separation; foot-based preference     | Heavy fabrication, structural steel, mixed industrial environments                    |
| 50 in / 1270 mm | Increased separation for larger loads              | General heavy industry; loads requiring greater stand-off due to geometry             |
| 5 ft / 1524 mm  | Heavy fabrication stand-off                        | Large structural members, heavy machinery where load geometry prevents close approach |
| 6 ft / 1829 mm  | Extended rigid separation                          | Large modules, wide structures, offshore lifts requiring high separation              |
| 72 in / 1829 mm | Inch-based equivalent of 6 ft                      | Same application context; inch-based ordering preference                              |
| 8 ft / 2438 mm  | Maximum practical rigid stand-off                  | Very large lifts; beyond this, flexible interfaces are more appropriate               |
| 96 in / 2438 mm | Inch-based equivalent of 8 ft                      | Same application; inch-based ordering preference                                      |



**INDUSTRIAL BLUE — FOOT-BASED RANGE**

2 ft · 3 ft · 4 ft · 5 ft · 6 ft · 8 ft

*Introduced to fill the engineering gaps between the original inch-based lengths. Industrial Blue distinguishes the foot-based range on site — making selection faster and reducing the risk of confusion.*

SECTION 10.4

When Does a Tagline Become the Better Solution?

RiggerSafe® controls loads inside the practical reach envelope. Beyond that reach, flexible interfaces become more effective engineering tools.

As required separation increases, the mechanical disadvantages of a longer rigid interface accumulate — rotational inertia increases, operator fatigue rises, and precise positional input becomes progressively harder to achieve. At some point, a flexible tension interface provides better engineering performance than continuing to extend the rigid interface.

**RIGID INTERFACE**

- Controlled push and pull at close working range
- Precise final orientation and positioning
- Fixed stand-off with direct mechanical input
- Effective up to approximately 8 ft practical separation

**FLEXIBLE TENSION INTERFACE (TAGLINE)**

- Swing and rotation management during transit
- Gross orientation at extended distances
- Tension only — cannot push
- Appropriate where required separation exceeds rigid reach



**ENGINEERING PRINCIPLE**

**INTERFACE CHANGE — NOT POSITION CHANGE**

When the required separation exceeds the practical reach of a rigid interface, change the interface — not the separation.

SECTION 10.5 · ONE HEAD — MULTIPLE APPLICATIONS

## Why One Geometry Serves Many Tasks

The RiggerSafe® head was engineered to a single geometry capable of performing multiple guidance functions across the wide variety of industrial load forms encountered in routine operations. Rather than optimising for a single application and requiring interchangeable attachments, its profile provides functional contact for pushing, pulling and positional correction across angular, rounded and framed load surfaces.

One geometry. Multiple industrial applications.

SECTION 10.6 · WHY ENGINEERING MATTERS

## Engineering Choices in the Assembly

ENGINEERED GEOMETRY VS. CUT PLATE

An injection-moulded head with designed internal geometry distributes contact forces across a larger surface area and resists concentrated loading more effectively than a flat plate with a simple notch.

INTERNAL RIB REINFORCEMENT

Structural ribs increase stiffness without adding mass. A ribbed section achieves similar stiffness to a solid heavy section at significantly lower weight, reducing operator fatigue over extended use.

COMPLETE ASSEMBLY TESTING

Validated at 300 kg push and 150 kg pull on the complete interface — because industrial performance depends on the behaviour of the entire assembly under real operating conditions.

MASS DOES NOT IMPROVE STEERING

The crane carries the load. The interface applies only lateral steering force. Unnecessary mass in the interface increases operator effort without any engineering benefit to the guidance function.

SECTION 10.7 · MATERIAL SELECTION

| COMPONENT         | MATERIAL            | KEY ENGINEERING RATIONALE                                                                                                                   |
|-------------------|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| Head              | Engineering polymer | Impact resistance; non-conductive; allows complex internal rib geometry; temperature limits apply.                                          |
| Standard inserts  | Rubber              | Grip and load surface protection. Accelerated wear on abrasive mill scale and rough fabrication surfaces.                                   |
| Aluminium inserts | Aluminium           | For abrasive surfaces where rubber wear is excessive. Not a high-temperature solution — polymer components still impose temperature limits. |
| Shaft             | Fibreglass          | Lightweight; high stiffness-to-weight ratio; non-conductive. Not currently certified electrical protective equipment.                       |

## SECTION 10.8

## Understanding Load Control Forces

The crane carries one hundred percent of the vertical weight. The guidance interface applies only the horizontal steering force needed to influence the load's orientation, direction and position. A tugboat moves a 100,000-tonne ship not by carrying its weight but by overcoming its motion, inertia and drift. The same principle governs suspended load guidance.

**ENGINEERING INSIGHT**

Centre of gravity drives rotation; rotational inertia resists correction; contact point geometry determines the available moment arm. The professional rigger applies guidance force — not lifting force.

Understanding these forces governs both selection and use of the interface.

## SECTION 10.9 · COLOUR SYSTEM

The RiggerSafe® colour system identifies product families and working length ranges on site. Colour supports identification and operational efficiency — it does not change the engineering selection criteria. Future colour systems may evolve as the product range develops.

**YELLOW**

Standard range

**NEON GREEN**

High-visibility range

**INDUSTRIAL BLUE**

Foot-based range · 2 ft – 8 ft

## SECTION 10.10 · PRACTICAL CARE

**BEFORE USE — INSPECT**

- Head for damage, cracking or deformation
- Contact inserts for wear or loss
- Shaft for bending, cracking or impact damage
- Handle and central support for security
- Fasteners for correct condition
- No evidence of heat, prior overload or unauthorised modification

**NEVER DO**

- Do not lever under or lift any portion of a load
- Do not strike the head against structures
- Do not use as a pry bar or extraction tool
- Do not attempt to arrest a falling load
- Do not drag across abrasive surfaces
- Do not modify without manufacturer approval

SECTION 10.11

Chapter Summary

Rigid guidance interfaces are not selected by habit. They are selected by engineering judgement. The correct interface is not the shortest available, nor the longest available. It is the interface that enables the required guidance objective while maintaining the practical separation established during lift planning.

TABLE 10.2 — CHAPTER 10 IN BRIEF

| POSITION                   | STATEMENT                                                                                                                                                                                         |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Interface last             | The interface is the consequence of engineering judgement. The required working position determines the interface — not the other way around.                                                     |
| Ten variables              | Selection depends on required separation, load geometry, precision, working space, suspended height, landing environment, surface condition, temperature, electrical exposure and interface type. |
| Range by design            | Multiple working lengths exist to eliminate the engineering compromise of choosing between too short and unnecessarily long. Each length is a deliberate engineering position.                    |
| Tagline threshold          | Beyond the practical reach of a rigid interface, a flexible tension interface becomes the better engineering solution. Change the interface — not the separation.                                 |
| One geometry               | One head design serves the full range. The operator concentrates on the guidance objective — not on selecting interchangeable attachments.                                                        |
| The crane carries the load | The interface applies only lateral steering force. Understanding this distinction governs both selection and use.                                                                                 |
| Appropriate, not maximum   | The objective is the shortest interface that provides the required separation while preserving effective guidance.                                                                                |

CLOSING STATEMENT

The best interface is not defined by its length. It is defined by how well it enables the rigger to apply professional judgement from the position where the work can be performed most safely.

PUBLICATION DETAILS

Chapter 10 — Publication Record

TABLE 10.3 — FIGURES AND TABLES INDEX

| REFERENCE   | TITLE                                                        | PAGE |
|-------------|--------------------------------------------------------------|------|
| Figure 10.1 | RiggerSafe® Yellow — standard working length range           | 03   |
| Figure 10.2 | RiggerSafe® Neon Green — high-visibility range               | 05   |
| Figure 10.3 | RiggerSafe® Industrial Blue — foot-based complementary range | 07   |
| Table 10.1  | Working lengths: engineering purpose and typical application | 06   |
| Table 10.2  | Chapter 10 in brief                                          | 11   |
| Table 10.3  | Figures and tables index (this table)                        | 12   |

GENERAL NOTES AND LIMITATIONS

This chapter presents engineering guidance for the selection of rigid suspended-load guidance interfaces. It does not constitute a site procedure, a regulatory requirement or a substitute for the lifting plan, competent lifting authority assessment or applicable site rules.

Working length selection involves engineering judgement applied to a specific task. Typical application guidance describes common patterns and does not prescribe the appropriate length for any individual lift. The actual required separation, established through lift planning, always takes precedence.

Part numbers, ordering codes, current pricing and availability are not included in this publication. Consult your PSC Hand Safety representative or [pschandsafety.com](https://pschandsafety.com) for current product information.

# Chapter 11

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## Engineering Different Load Geometries

### *Applying the RiggerSafe® Engineering Framework*

The engineering framework developed throughout this guidebook is intentionally universal. The principles governing guidance do not change from one industry to another. What changes is the geometry of the suspended load. This chapter demonstrates how the same engineering process is applied across the most common industrial load forms.

Geometry governs behaviour. Behaviour governs engineering decisions.

Different loads require different guidance. The engineering process never changes.

CHAPTER OVERVIEW

Geometry Is the Starting Point

A rectangular machinery skid, a long structural beam, a pipe bundle and a pressure vessel may all weigh the same, yet each behaves differently once suspended. Their movement envelopes, rotational characteristics, contact opportunities and guidance requirements are fundamentally different.

Professional riggers therefore begin every lifting task by studying the geometry of the load rather than relying solely on its weight. This chapter demonstrates how the same engineering process — established across Chapters 1 to 10 — is applied consistently across the most common industrial load forms.

This chapter is not a procedures catalogue. It is a geometry chapter. Every section uses the same engineering framework; only the load form changes.

CHAPTER AT A GLANCE

- 1. Engineering begins with geometry
- 2. Rectangular loads
- 3. Cylindrical loads
- 4. Long loads
- 5. Thin loads
- 6. Irregular loads
- 7. Flexible assemblies
- 8. High-precision placement
- 9. Sling-supported loads
- 10. Loads with limited contact opportunities
- 11. Applying the engineering framework

SECTION 11.1

Engineering Begins With Geometry

Weight determines crane selection. Geometry determines guidance. Before selecting a guidance method, the lifting team should evaluate: overall dimensions, centre of gravity, available contact opportunities, tendency to rotate or roll, expected movement, and landing constraints. Loads with identical mass frequently require entirely different guidance strategies because their geometry governs how they behave once suspended.

Geometry governs behaviour. Behaviour governs engineering decisions.

ENGINEERING PRINCIPLE

CONTACT OPPORTUNITY

A contact opportunity is any structurally suitable location where controlled guidance forces can be introduced into a suspended load without compromising stability, damaging the load, or exposing personnel to line-of-fire hazards. The number and quality of available contact opportunities are determined by load geometry.

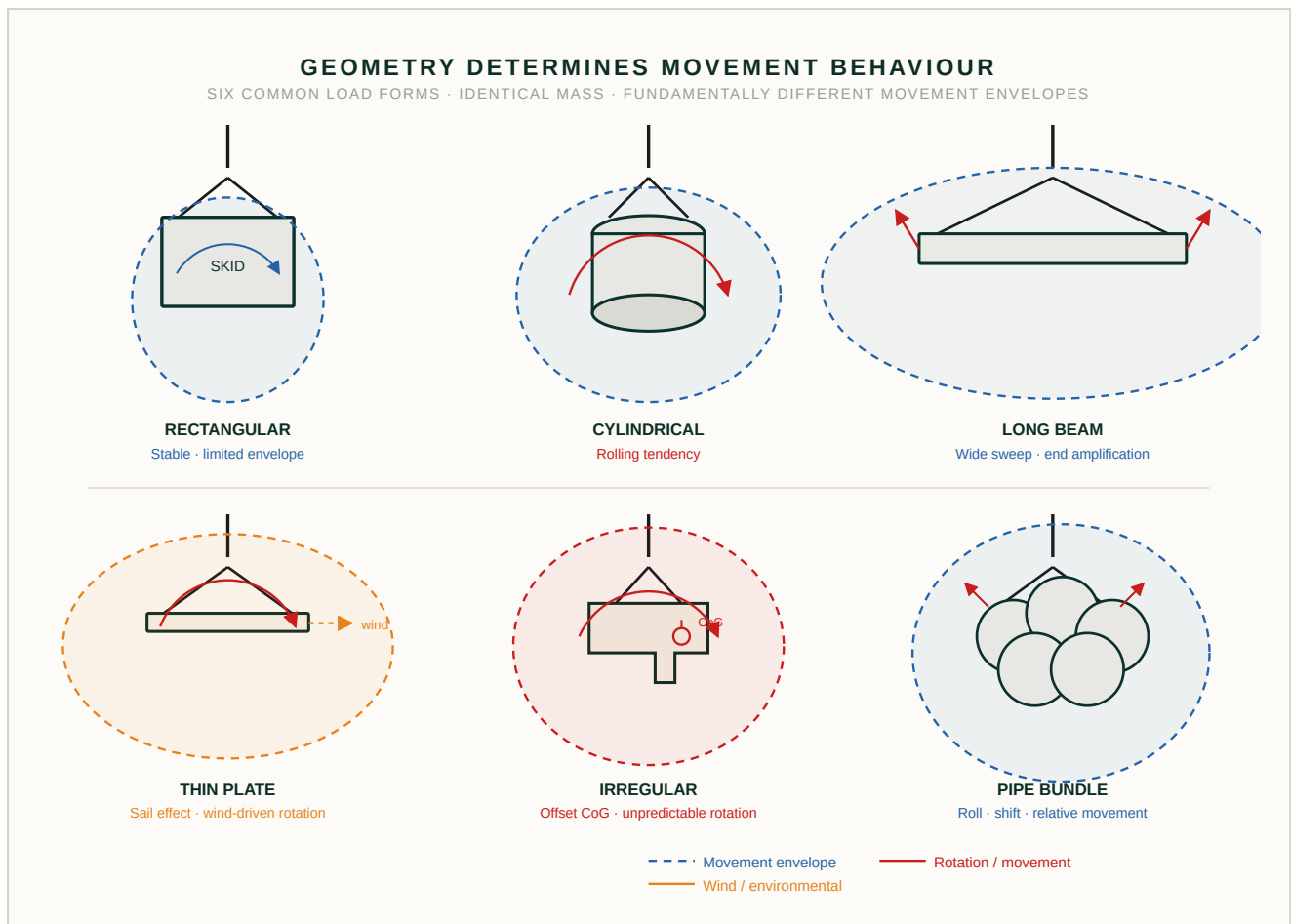


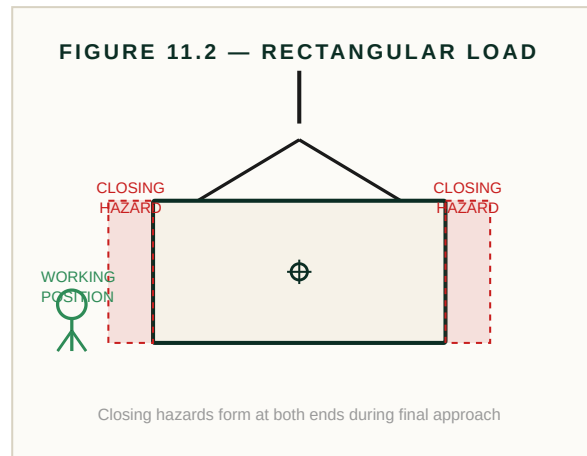
**FIGURE 11.1** — Different geometries create different movement characteristics despite identical mass and identical engineering principles. The movement envelope — not the load weight — determines the required guidance approach for each lift.

## SECTION 11.2

## Rectangular Loads

Rectangular loads — machinery skids, fabricated frames, containers and equipment packages — typically present broad flat contact surfaces and relatively stable orientation. Their large inertia during travel means they resist sudden movements but carry considerable momentum once moving.

The primary guidance objectives are maintaining orientation, preventing unwanted rotation and positioning accurately during final approach. Most hand injuries with rectangular loads occur during the final stages of positioning, when workers instinctively move closer to verify alignment. The engineering objective remains maintaining separation while achieving controlled positioning.

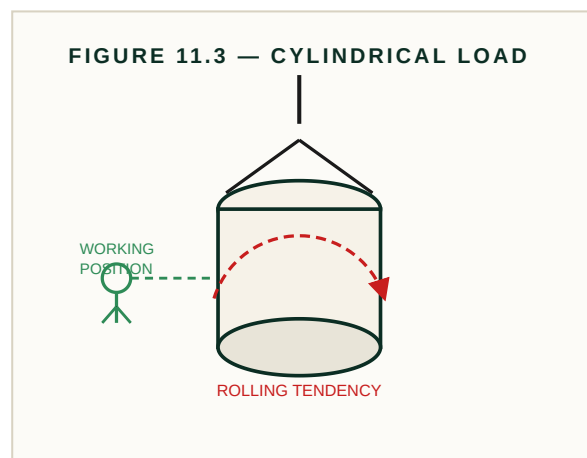


## SECTION 11.3

## Cylindrical Loads

Cylindrical loads — pipe, pressure vessels, rolls and shafts — rarely remain rotationally stable once suspended. Their curved surface means the contact point between the load and any support shifts continuously as rotation occurs, making them fundamentally different from rectangular loads to guide.

Rolling behaviour should always be anticipated rather than corrected after it develops. The guidance interface should influence rotation while maintaining positive control throughout the movement. Once a cylindrical load develops momentum, it requires more input to correct than if the tendency had been managed from the outset.



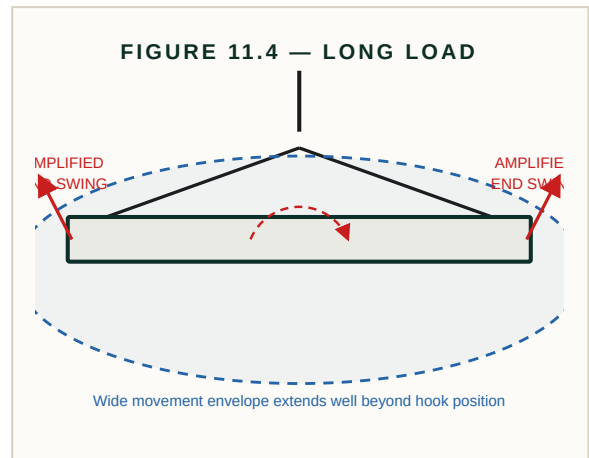
Round loads naturally seek rotation. Engineering anticipates that behaviour before it begins.

## SECTION 11.4

## Long Loads

Structural beams, pipe strings, fabricated modules and long machinery assemblies share a critical characteristic: as load length increases, small rotational movements at the centre produce large displacement at the extremities. The working position must account for the enlarged movement envelope, not just the hook position.

Long loads also exhibit delayed response — a guidance input applied at one end takes time to propagate through the load. Professional riggers allow for this delay rather than applying increasing force when the expected movement does not immediately materialise.

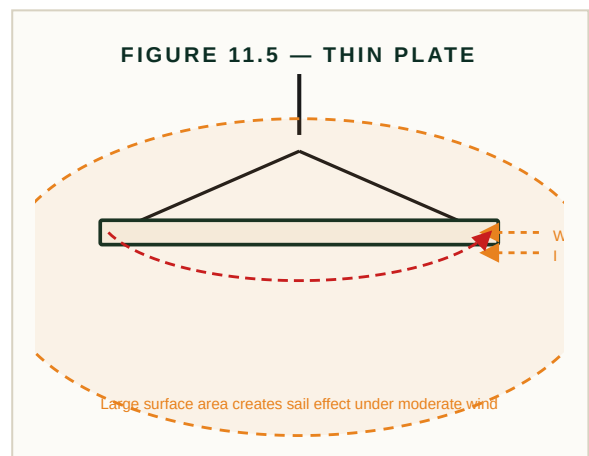


## SECTION 11.5

## Thin Loads

Steel plate, aluminium sheet and fabricated panels frequently behave according to surface area rather than weight. Their large flat surfaces act as sails under moderate wind conditions, causing movement that is entirely disproportionate to the load mass. Environmental conditions therefore become critically important during lift planning.

Thin loads can also rotate rapidly due to their low rotational inertia once a rotational force is applied. This combination — wind sensitivity and rapid rotation — makes thin plates among the most demanding loads to guide safely.



## SECTION 11.6

## Irregular Loads

Pumps, compressors, motors, valves and fabricated equipment share an offset centre of gravity, asymmetrical geometry and multiple projections. Irregular loads often rotate immediately after lifting as they seek equilibrium around the suspension point. Professional riggers anticipate this movement before guidance begins.

The offset CoG should be identified during lift planning, and the expected rotation direction should be understood before the load leaves the ground. Guidance inputs applied against an anticipated rotation are far more effective than reactive inputs applied after the rotation has already developed momentum.

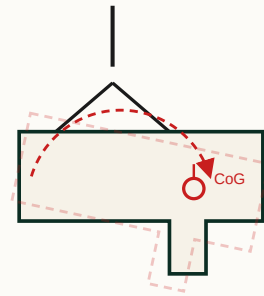
## SECTION 11.7

## Flexible Assemblies

Pipe bundles, bundled products and sling-supported assemblies behave as multiple interacting bodies despite being suspended as a single lift. Individual components can shift relative to each other, changing the overall geometry of the assembly mid-lift and introducing movement that is difficult to anticipate from the hook position alone.

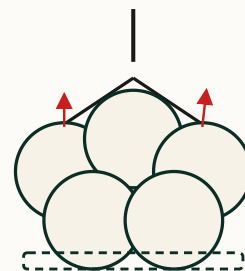
Guidance should consider the movement of the complete assembly rather than individual components. The binding or bundling arrangement significantly affects how relative movement between components can develop during the lift.

FIGURE 11.6 — IRREGULAR LOAD



Offset CoG drives rotation immediately at lift-off

FIGURE 11.7 — FLEXIBLE ASSEMBLY



Relative movement between components

Each component responds independently to guidance inputs

## SECTION 11.8

## High-Precision Placement

The final stages of positioning require the greatest precision while simultaneously presenting the highest potential for hand exposure.

Machinery foundations, equipment installation, structural alignment and maintenance activities share a common characteristic: minimal allowable movement combined with very small positional corrections. As the load approaches its final position, the closing hazard reaches its maximum, the working space typically narrows and the pressure to confirm alignment visually increases.

Workers often reduce separation during precision alignment because they believe that closer proximity improves accuracy. Engineering experience demonstrates otherwise. Positional control is determined by the quality of the guidance interface and the precision of crane input, not by the proximity of the worker to the load.

### ENGINEERING INSIGHT — SMALL CORRECTIONS REQUIRE BETTER ENGINEERING, NOT SMALLER SEPARATION

Professional guidance systems achieve precision by improving the interface rather than reducing distance. A rigid engineered control interface at the correct working length delivers more consistent positional correction than direct hand contact at close range, because the interface transmits controlled mechanical input rather than imprecise manual pressure.

The objective during high-precision placement is not increasing the force applied. It is increasing positional control — which is achieved by maintaining effective working separation, not by eliminating it.

**TABLE 11.1 — LOAD GEOMETRY: PRIMARY MOVEMENT, PREFERRED CONTACT OPPORTUNITY AND MAIN HAZARD**

| LOAD GEOMETRY     | PRIMARY MOVEMENT                  | PREFERRED CONTACT OPPORTUNITY                                                                              | MAIN GUIDANCE HAZARD                                                            |
|-------------------|-----------------------------------|------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| Rectangular       | Rotation · lateral drift          | Corner or face — predictable, structurally stable contact opportunity                                      | Closing hazard at final approach; workers move closer to verify alignment       |
| Cylindrical       | Rolling · axial rotation          | Tangent point on curved surface — contact opportunity migrates as load rolls                               | Uncontrolled rotation; contact point migration removes guidance effectiveness   |
| Long beam         | End sweep · swing                 | End face or flange — best contact opportunity; maximises moment arm for rotational correction              | Amplified end displacement; small centre rotation becomes large end swing       |
| Thin plate        | Sail effect · rapid rotation      | Edge — highest-quality contact opportunity; resists wind-driven rotation                                   | Wind-driven rotation; large surface area relative to mass                       |
| Irregular         | CoG-driven rotation at lift-off   | Structural frame or rigid projection — only reliable contact opportunities on irregular loads              | Sudden rotation immediately after lift-off; direction must be predicted         |
| Flexible assembly | Relative inter-component movement | Outer bundle face — only structurally coherent contact opportunity across the assembly                     | Internal component movement independent of overall assembly guidance            |
| Sling-supported   | Sling settling · CoG shift        | Load surface clear of sling interference — contact opportunity constrained by sling geometry               | Dynamic settling changes geometry mid-lift; tagline often more appropriate      |
| Limited contact   | Same as underlying geometry       | Identified safe zones only — contact opportunities must be established during lift planning                | Few contact opportunities; wrong contact point damages load or defeats guidance |
| High-precision    | Minimal · fine correction         | Any stable surface providing controlled push or pull — quality of contact opportunity determines precision | Proximity assumption: workers reduce separation believing it improves accuracy  |

## SECTION 11.9

## Sling-Supported Loads

A sling introduces dynamic behaviours that no rigidly suspended load possesses. The geometry of the lift changes continuously throughout the operation as the sling interacts with the load.

When a load is suspended by slings rather than a direct hook connection, the sling itself becomes part of the load system — and it behaves differently from the load it supports. Sling stretch, leg angle variation, basket and choke configurations, and the settling of the load into the sling geometry all affect how the suspended assembly will move and how guidance can be effectively applied.

### ENGINEERING CHARACTERISTICS

#### SLING STRETCH AND LEG ANGLE

As the load rises, sling legs tighten. The angle between them changes, shifting the effective suspension point. CoG calculation and load balance may change slightly during the lift.

#### LOAD SETTling

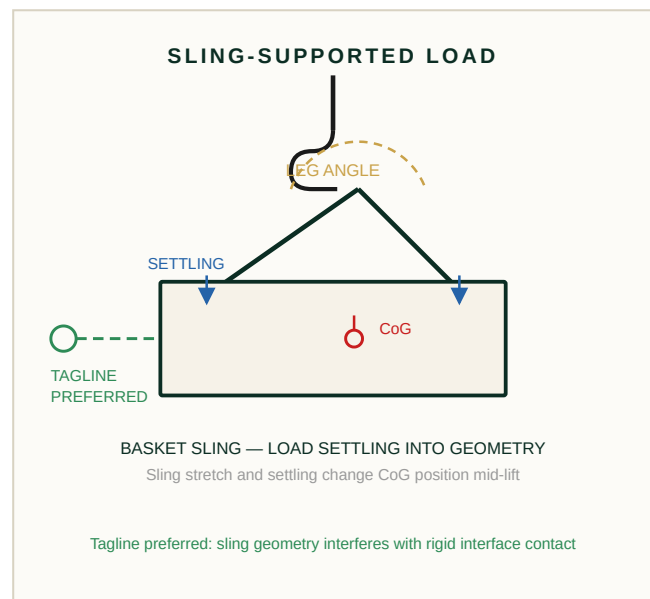
In basket and choker configurations, the load settles into the sling geometry during lift-off. This settling changes the load's orientation and can introduce rotation or lateral displacement not present on the ground.

#### MULTIPLE SUSPENSION POINTS

Multiple independent sling legs can behave asymmetrically if load weight is unevenly distributed. One leg may carry more load than others, creating a lean that the guidance interface must correct.

#### SOFT INTERFACE BETWEEN CRANE AND LOAD

The sling absorbs and slightly delays the transmission of crane input to the load. This means the load response is slightly less direct than a hook-attached lift and guidance must account for that damping effect.



### WHEN TAGLINES BECOME THE CORRECT SOLUTION

Sling-supported loads often represent the natural transition point from rigid to flexible interfaces introduced in Chapter 9. The sling geometry can physically interfere with rigid interface contact — the sling legs occupy the positions where a rigid interface would most naturally engage the load surface. A tagline, operating at greater distance and transmitting guidance through tension, avoids this interference entirely.

Where the sling configuration prevents effective rigid interface engagement, or where load settling will change the geometry mid-lift, a flexible tension interface is the engineering preference — not a compromise.

SECTION 11.10

Loads with Limited Contact Opportunities

Some loads are not different because of their weight, their length or their tendency to rotate. They are different because there are very few safe locations where a guidance interface can act effectively.

Polished stainless steel vessels, painted equipment, insulated pipe, lattice structures and oddly shaped castings all present the same fundamental engineering problem: where can controlled force actually be introduced? The underlying geometry may be simple — a cylindrical vessel, a rectangular frame — but the available contact opportunity is severely restricted by the need to avoid damage, by the fragility of surface coatings, or by the geometry of projections and voids that make contact mechanically impractical.

COMMON EXAMPLES AND CONTACT CONSTRAINTS

| LOAD TYPE                 | CONTACT CONSTRAINT                                                                                        |
|---------------------------|-----------------------------------------------------------------------------------------------------------|
| Polished stainless vessel | Surface contact with rubber inserts only; pressure marks on mirror-polished surfaces are unacceptable     |
| Painted equipment         | Contact limited to unpainted structural sections; painted surfaces damage under interface pressure        |
| Insulated pipe            | Insulation must not be compressed or punctured; contact restricted to flanges and structural end fittings |
| Lattice structure         | Open geometry provides minimal flat contact area; engagement limited to chord members and panel points    |
| Shaped casting            | Machined surfaces, bores and faces must not be contacted; contact limited to unmachined structural areas  |

THE ENGINEERING QUESTION

For restricted-contact loads, the first engineering question is not *"How do I control this load?"* It is: *"Where can controlled force actually be introduced?"*

Only after the available contact opportunities have been identified should the guidance method be selected. If the available contact opportunities are insufficient for a rigid interface to operate effectively, a flexible tension interface — tagline — provides an alternative that does not require surface contact at the critical location.

If no guidance method can operate without risking load damage, the rigging arrangement should be reconsidered — not the separation distance.

PLANNING FOR LIMITED CONTACT OPPORTUNITIES

|                                                                                                                                                                                                              |                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>BEFORE THE LIFT</b></p> <p>Identify all acceptable contact opportunitys during lift planning — not during the lift. Mark or communicate safe zones to the guidance team before the hook is loaded.</p> | <p><b>INTERFACE SELECTION</b></p> <p>Select the contact configuration appropriate to the surface — rubber inserts for sensitive surfaces, aluminium inserts where abrasion is the concern, tagline where no rigid contact is practical.</p> | <p><b>RIGGING REVIEW</b></p> <p>If no acceptable contact opportunity allows effective guidance, review the rigging arrangement before the lift — not after. Rigging that correctly presents safe contact faces simplifies the guidance task entirely.</p> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Geometry governs behaviour. Behaviour governs engineering decisions.

## SECTION 11.9

## Applying the Engineering Framework

Regardless of geometry, the engineering sequence remains identical. Professional judgement is achieved through consistency rather than improvisation.

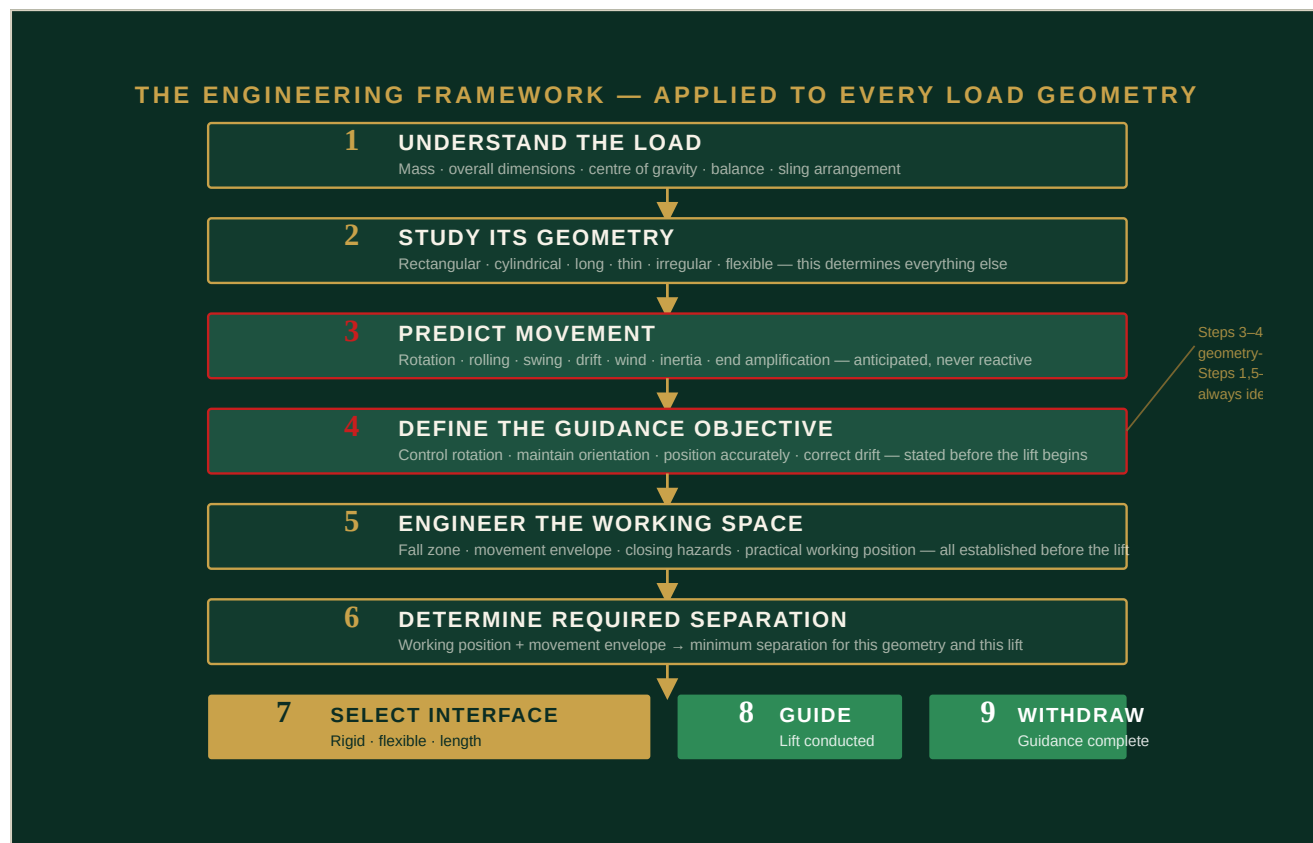


**FIGURE 11.8** — The engineering decision sequence applied universally. Steps 3 and 4 — predicting movement and defining the guidance objective — vary with geometry. All other steps remain identical regardless of the load form.

## CHAPTER 11

## Chapter Summary

Every suspended load presents a unique engineering problem. The solution is not memorising procedures for every industry or every product. It is applying the same disciplined engineering process to every load, regardless of its shape, size or operating environment.

Understanding geometry allows the rigger to anticipate behaviour. Anticipating behaviour allows guidance to be planned. Planned guidance allows safe separation to be maintained throughout the operation.

Different loads require different guidance. The engineering process never changes.

TABLE 11.2 — CHAPTER 11 IN BRIEF

| POSITION                    | STATEMENT                                                                                                                                                                                              |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Weight vs geometry          | Weight determines crane selection. Geometry determines guidance. Loads of identical mass may require completely different guidance approaches because geometry governs how they behave once suspended. |
| Anticipation not reaction   | Movement should be predicted from geometry before the lift begins. Reactive guidance — correcting after movement has developed — is less effective and less safe than anticipatory guidance.           |
| Rectangular stability       | Rectangular loads appear stable but present closing hazards at final approach. The engineering objective remains maintaining separation even when the load appears stationary.                         |
| Cylindrical rolling         | Cylindrical loads continuously seek rotation. Guidance inputs that anticipate rolling are more effective than those that respond to it.                                                                |
| Long loads amplify          | Small rotational inputs at the centre of a long load produce large displacement at its ends. The working position must account for the full movement envelope, not just the hook.                      |
| Thin loads sail             | Thin plate behaves according to surface area rather than weight. Wind conditions become a primary engineering variable for flat suspended loads.                                                       |
| Irregular loads rotate      | Offset centre of gravity causes immediate rotation at lift-off. The rotation direction should be identified during planning — before the load leaves the ground.                                       |
| Precision through interface | High-precision placement requires better interface engineering, not reduced separation. Proximity does not improve positional control.                                                                 |
| Framework is universal      | The nine-step engineering sequence applies to every load geometry. Steps 3 and 4 vary; all other steps are identical regardless of the load form.                                                      |

### CLOSING STATEMENT

Professional riggers do not begin by asking what the load weighs. They begin by understanding how the load will behave. Engineering begins with geometry.

### BRIDGE TO CHAPTER 12 — THE ENGINEERING FRAMEWORK APPLIED

TABLE 11.5 — GEOMETRY, BEHAVIOUR, PREFERRED CONTACT OPPORTUNITY AND MAIN HAZARD: COMPLETE REFERENCE

| GEOMETRY          | DOMINANT BEHAVIOUR                 | PREFERRED CONTACT OPPORTUNITY                   | MAIN HAZARD                             |
|-------------------|------------------------------------|-------------------------------------------------|-----------------------------------------|
| Rectangular       | Rotation · lateral drift           | Face or corner — stable and predictable         | Closing hazard at final approach        |
| Cylindrical       | Rolling · axial rotation           | Tangent point — migrates as load rolls          | Uncontrolled rotation                   |
| Long              | End amplification · swing          | End face or flange — maximises moment arm       | Amplified end displacement              |
| Thin plate        | Sail effect · rapid rotation       | Edge — resists wind-driven rotation             | Wind-driven rotation                    |
| Irregular         | CoG-driven rotation at lift-off    | Structural frame — avoids fragile fittings      | Sudden rotation at lift-off             |
| Flexible assembly | Relative inter-component movement  | Outer bundle face — not individual components   | Internal component shift                |
| Sling-supported   | Sling settling · CoG shift         | Load surface clear of sling — tagline preferred | Dynamic geometry change mid-lift        |
| Limited contact   | Same as underlying geometry        | Identified safe zones only                      | Contact damage or no effective guidance |
| High-precision    | Fine correction · minimal movement | Any stable structural surface                   | Proximity assumption reduces separation |

## PUBLICATION DETAILS

## Chapter 11 — Publication Record

TABLE 11.3 — FIGURES AND TABLES INDEX

| REFERENCE   | TITLE                                                                                           | PAGE |
|-------------|-------------------------------------------------------------------------------------------------|------|
| Figure 11.1 | Geometry determines movement behaviour — six common load forms compared                         | 03   |
| Figure 11.2 | Rectangular load — working position, closing hazards and contact areas                          | 04   |
| Figure 11.3 | Cylindrical load — rolling tendency, rotation and contact management                            | 04   |
| Figure 11.4 | Long load — amplified end displacement and enlarged movement envelope                           | 05   |
| Figure 11.5 | Thin plate — sail effect and wind-driven rotation                                               | 05   |
| Figure 11.6 | Irregular load — offset centre of gravity and rotation at lift-off                              | 06   |
| Figure 11.7 | Flexible assembly — relative component movement within the bundle                               | 06   |
| Figure 11.8 | The engineering decision sequence — applied universally across all load geometries              | 10   |
| Table 11.1  | Load geometry: primary movement, preferred contact opportunity and main hazard                  | 07   |
| Figure 11.9 | Sling-supported load — basket arrangement, settling and tagline preference                      | 08   |
| Table 11.4  | Limited contact loads — types and contact constraints                                           | 09   |
| Table 11.2  | Chapter 11 in brief                                                                             | 11   |
| Table 11.5  | Complete geometry reference — dominant behaviour, preferred contact opportunity and main hazard | 11   |
| Table 11.3  | Figures and tables index (this table)                                                           | 12   |

## GENERAL NOTES

This chapter presents engineering reasoning applicable to common suspended load geometries. It does not constitute industry-specific lifting guidance, site procedures or regulatory requirements. The geometry characteristics described are engineering generalisations intended to support planning and professional judgement.

Every specific lift requires assessment by a competent person using the applicable site procedures, regulatory requirements and lifting plan. The engineering framework described here supports that assessment — it does not replace it.

## LOOKING AHEAD · CHAPTER 12

Chapter 12 concludes The RiggerSafe® Guidebook by presenting the complete engineering philosophy — bringing together the principles of load exposure, guidance engineering, spatial reasoning, interface selection and geometry assessment into the unified RiggerSafe® Engineering Framework.

# Chapter 12

---

## Implementing the RiggerSafe® Engineering Method

*From Engineering Method to Field Implementation*

Eleven chapters have established the engineering philosophy, hazard model, spatial reasoning, interface selection, load geometry and working separation that constitute the RiggerSafe® Engineering Method. This final chapter translates those principles into a repeatable process for lift planning, equipment selection, training and procurement.

---

Engineering is complete only when the correct interface is placed in the hands of the worker.

CHAPTER OVERVIEW

# The Complete Engineering Method in Practice

The preceding chapters established that hand exposure during suspended load handling is not an unavoidable consequence of lifting operations. It is an engineering problem that can be systematically reduced through appropriate planning, working position, interface selection and disciplined execution.

This final chapter translates those principles into a practical implementation framework. Rather than introducing new concepts, it brings together the complete RiggerSafe® Engineering Method into a repeatable process applicable during lift planning, equipment selection, training and procurement.

Every lift is different. The engineering method should remain the same.

CHAPTER AT A GLANCE

- 1. The complete engineering method
- 2. Selecting the appropriate RiggerSafe®
- 3. The RiggerSafe® range
- 4. Product identification
- 5. Colour identification
- 6. Accessories and options
- 7. Inspection before use
- 8. Good operating practice
- 9. Implementation checklist
- 10. The engineering philosophy

SECTION 12.1

## The RiggerSafe® Engineering Method™

Every suspended load should be approached using the same sequence. No step should be omitted. No step should be reversed.

|                                      |                                     |
|--------------------------------------|-------------------------------------|
| 1 Understand the task                | 2 Study the load and its geometry   |
| 3 Predict movement                   | 4 Identify the guidance objective   |
| 5 Engineer the working space         | 6 Determine the required separation |
| 7 Decide rigid or flexible interface | 8 Select the appropriate interface  |
| 9 Conduct the lift                   | 10 Withdraw and review              |

Professional judgement is achieved through consistency — not improvisation.

## PHASE 1 — UNDERSTAND

### 1 UNDERSTAND THE TASK

Purpose · scope · environment · relevant regulations · site constraints

Ch 1–3

## PHASE 2 — GEOMETRY

### 2 STUDY THE LOAD AND ITS GEOMETRY

Mass · dimensions · CoG · contact opportunities · sling arrangement · balance

### 3 PREDICT MOVEMENT

Rotation · rolling · swing · drift · sail · end amplification · settling

Ch 11

### 4 IDENTIFY THE GUIDANCE OBJECTIVE

Maintain orientation · correct rotation · position accurately · manage swing · control landing

## PHASE 3 — HAZARD SPACE

### 5 ENGINEER THE WORKING SPACE

Fall zone · movement envelope · landing footprint · closing hazards · practical working position

Ch 9

### 6 DETERMINE REQUIRED SEPARATION

Working position + movement envelope = minimum practical separation for this specific lift

## PHASE 4 — INTERFACE SELECTION

### 7 SELECT APPROPRIATE INTERFACE TYPE AND LENGTH

Rigid or flexible · working length · colour/configuration · verify against required separation

Ch 10

## PHASE 5 — EXECUTION

### 8 CONDUCT THE LIFT

Apply guidance from established working position · accompany the operation · reassess continuously

### 9 WITHDRAW ONCE GUIDANCE IS COMPLETE

Interface withdrawn before load reaches full support · never held during final landing

Ch 5

### 10 REVIEW THE OPERATION

Capture field observations · identify engineering improvements · feed back into next lift plan

Figure 12.1 — The RiggerSafe® Engineering Method™ · Complete Decision Sequence · The signature figure of this guidebook

SECTION 12.2

Selecting the Appropriate RiggerSafe®

The interface should never be selected by habit. Selection begins with engineering. The ten variables below should always be reviewed before a specific configuration is chosen.

|                         |                          |                    |
|-------------------------|--------------------------|--------------------|
| REQUIRED SEPARATION     | LOAD GEOMETRY            | REQUIRED PRECISION |
| AVAILABLE WORKING SPACE | ENVIRONMENTAL CONDITIONS | SURFACE CONDITION  |
| TEMPERATURE             | ELECTRICAL EXPOSURE      | WORKER POSTURE     |
| RIGID OR FLEXIBLE?      |                          |                    |

SECTION 12.3

The RiggerSafe® Range

Every model in the RiggerSafe® family shares the same head geometry, operating philosophy and engineering methodology. Working length — not operating technique — is the primary variable.

ENGINEERING LENGTHS — TRADITIONAL RANGE

| LENGTH | ENGINEERING PURPOSE                                       |
|--------|-----------------------------------------------------------|
| 21 in  | Close-in precision guidance; minimum stand-off            |
| 42 in  | General industrial stand-off; standard engineering length |
| 50 in  | Heavy fabrication; increased separation                   |
| 72 in  | Large suspended loads; extended reach                     |
| 96 in  | Maximum practical rigid stand-off, inch-based             |

ENGINEERING LENGTHS — EXTENDED RANGE

| LENGTH | ENGINEERING PURPOSE                            |
|--------|------------------------------------------------|
| 2 ft   | Precision in confined plant areas              |
| 3 ft   | Fabrication benches; light industrial assembly |
| 4 ft   | General industrial guidance                    |
| 5 ft   | Structural fabrication; heavy industrial       |
| 6 ft   | Large assemblies; offshore; wide structures    |
| 8 ft   | Maximum practical rigid separation             |

ENGINEERING SELECTION PRINCIPLE

Select the shortest interface that provides the required separation while preserving effective guidance. Longer is not automatically better. The engineering objective is appropriate length — not maximum length.

## SECTION 12.4

## Product Identification and Engineering Specification

The following table provides the engineering specification for procurement and engineering reference. This is not a marketing description. Each entry states the engineering purpose of the configuration.

**TABLE 12.1 — RIGGERSAFE® ENGINEERING SPECIFICATION REFERENCE**

| PART NO.     | LENGTH                 | COLOUR     | PUSH / PULL     | TYPICAL ENGINEERING APPLICATION                                              |
|--------------|------------------------|------------|-----------------|------------------------------------------------------------------------------|
| HSF-RS-Y-21  | 21 in / 535 mm         | Yellow     | 300 kg / 150 kg | Close-quarters precision guidance; minimum stand-off; confined access        |
| HSF-RS-Y-42  | 42 in / 1067 mm        | Yellow     | 300 kg / 150 kg | General industrial guidance; standard engineering length for routine lifting |
| HSF-RS-Y-50  | 50 in / 1270 mm        | Yellow     | 300 kg / 150 kg | Heavy fabrication; moderate additional separation over 42 in                 |
| HSF-RS-Y-72  | 72 in / 1829 mm        | Yellow     | 300 kg / 150 kg | Large suspended loads requiring extended rigid reach                         |
| HSF-RS-Y-96  | 96 in / 2438 mm        | Yellow     | 300 kg / 150 kg | Maximum practical rigid stand-off; inch-based procurement preference         |
| HSF-RS-NG-21 | 21 in / 535 mm         | Neon Green | 300 kg / 150 kg | High-visibility close-quarters guidance; low-light and busy environments     |
| HSF-RS-NG-42 | 42 in / 1067 mm        | Neon Green | 300 kg / 150 kg | High-visibility general industrial guidance; active sites                    |
| HSF-RS-NG-50 | 50 in / 1270 mm        | Neon Green | 300 kg / 150 kg | High-visibility heavy fabrication guidance                                   |
| HSF-RS-NG-72 | 72 in / 1829 mm        | Neon Green | 300 kg / 150 kg | High-visibility extended rigid reach; offshore and fabrication yards         |
| HSF-RS-NG-96 | 96 in / 2438 mm        | Neon Green | 300 kg / 150 kg | High-visibility maximum rigid stand-off                                      |
| HSF-RS-B-24  | 24 in / 610 mm (2 ft)  | Ind. Blue  | 300 kg / 150 kg | Precision machinery positioning; confined plant areas                        |
| HSF-RS-B-36  | 36 in / 915 mm (3 ft)  | Ind. Blue  | 300 kg / 150 kg | Fabrication bench work; light industrial assembly                            |
| HSF-RS-B-48  | 48 in / 1220 mm (4 ft) | Ind. Blue  | 300 kg / 150 kg | General industrial guidance; foot-based procurement preference               |
| HSF-RS-B-60  | 60 in / 1524 mm (5 ft) | Ind. Blue  | 300 kg / 150 kg | Structural fabrication; heavy industrial stand-off                           |
| HSF-RS-B-72  | 72 in / 1829 mm (6 ft) | Ind. Blue  | 300 kg / 150 kg | Large assemblies; offshore lifts requiring greater separation                |
| HSF-RS-B-96  | 96 in / 2438 mm (8 ft) | Ind. Blue  | 300 kg / 150 kg | Maximum practical rigid guidance separation before transition to taglines    |

Push and pull ratings apply to the complete assembled interface under independent test conditions. These are not operational load ratings and should not be interpreted as the maximum forces routinely applied during guidance. All models: non-load-bearing guidance tool — crane supports 100% of vertical load. Shaft: fibreglass. Head: engineering polymer. Inserts: rubber (standard). Aluminium insert option available for abrasive environments. Not certified electrical protective equipment.

SECTION 12.5

## Colour Identification

Colour is used for rapid site identification and does not determine engineering capability. The same head geometry, assembly engineering and validation ratings apply across all colour variants.

|                                                                                                         |                                                                                                                              |                                                                                                         |
|---------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
| <b>YELLOW</b><br>Standard industrial range.<br>Traditional inch-based lengths plus complementary sizes. | <b>NEON GREEN</b><br>High-visibility range. Assists rapid identification in active environments and under variable lighting. | <b>INDUSTRIAL BLUE</b><br>Foot-based complementary range.<br>Distinguishes 2 ft – 8 ft lengths on site. |
|---------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|

SECTION 12.6

## Accessories and Engineering Adaptations

| OPTION                            | ENGINEERING RATIONALE                                                                                                                                                                                          |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Aluminium contact inserts         | Engineering adaptation for applications where highly abrasive load surfaces cause excessive rubber insert wear. Not a high-temperature solution — polymer head components retain their own temperature limits. |
| Rubber contact inserts (standard) | Grip and load surface protection in standard industrial environments. Renewable wear component — inspect and replace as required.                                                                              |
| Fibreglass shaft                  | Standard across the range. Provides non-conductive separation in environments where incidental contact with energised equipment is possible. Not currently certified electrical protective equipment.          |

SECTION 12.7

## Inspection Before Use

Every interface should be inspected before entering service on each occasion. Inspection is not a formality — it is confirmation that the assembly will perform as engineered.

- Shaft — inspect for bending, cracking or impact damage along full length
- Head attachment — confirm secure connection to shaft; check fasteners
- Contact inserts — inspect for wear, damage or loss
- Handle security — confirm no looseness, movement or cracking
- Central guard — check for damage or deformation
- Visible impact damage — including sudden-load or shock events
- Evidence of heat exposure, overload or unauthorised modification
- If structural integrity is uncertain — remove from service

SECTION 12.8

# Good Operating Practice

The engineering method is applied by the professional rigger. These principles govern correct use throughout the operation.

## THE INTERFACE GUIDES — IT DOES NOT CARRY

Never support the vertical weight of the load through the interface. The crane carries the mass. The interface introduces only the lateral steering force required for guidance. Treating the interface as a load support is an engineering error and a misuse of the assembly.

## MAINTAIN TWO-HANDED CONTROL

Two-handed control provides balance, directional stability and the ability to respond quickly to changes in load behaviour. One-handed operation compromises both the quality of guidance input and the rigger's ability to withdraw safely.

## REMAIN OUTSIDE THE MOVEMENT ENVELOPE

The working position established during lift planning should be maintained throughout the operation. The practical working position is not fixed — it moves with the operation. Accompany the lift; do not stand inside the movement envelope.

## WITHDRAW ONCE GUIDANCE IS COMPLETE

The interface should be withdrawn before the load reaches its final support. The final moments of landing present the highest closing hazard. The rigger should be clear before tension is fully released from the rigging.

## REASSESS WHENEVER CONDITIONS CHANGE

If conditions change — wind increases, load behaviour changes, the landing position shifts — stop, reassess and re-establish the working position before continuing. The engineering decision sequence is not a one-time assessment; it is a continuous process throughout the lift.

## THE INTERFACE MUST NEVER BE USED TO

Support or carry load weight · act as a pry bar or lever · arrest a falling load · compensate for incorrect rigging · substitute for crane positioning · be modified without manufacturer approval.

## ENGINEERING INSIGHT — THE INTERFACE GUIDES THE LOAD. IT NEVER CARRIES IT.

The crane supports the suspended mass. The interface introduces only the force necessary to guide, rotate, steady or position the load. Confusing guidance force with load-carrying leads to poor interface selection and unrealistic expectations of assembly performance.

## SECTION 12.9

# Implementation Checklist

A repeatable engineering checklist for use during lift planning and pre-task review. Every item should be confirmed before the lift begins.

☐

### REVIEW THE LIFT PLAN

Confirm the lifting plan has been prepared by a competent person and addresses the specific load, environment and landing requirements.

☐

### IDENTIFY LOAD GEOMETRY

Determine the load form: rectangular, cylindrical, long, thin, irregular, flexible assembly, sling-supported or limited contact. Note available contact opportunities.

☐

### UNDERSTAND EXPECTED MOVEMENT

Predict rotation, rolling, swing, drift, sail effect or end amplification before the load leaves the ground.

☐

### IDENTIFY GUIDANCE OBJECTIVE

State specifically what the guidance interface must achieve: maintain orientation, control rotation, manage drift, assist final alignment.

☐

### ENGINEER THE WORKING SPACE

Identify fall zone, movement envelope, landing footprint, closing hazards and the practical working position for each stage of the lift.

☐

### ESTABLISH PRACTICAL SEPARATION

Confirm the minimum separation that must be maintained between the worker and the suspended load throughout the operation.

☐

### SELECT INTERFACE TYPE

Confirm whether a rigid interface (RiggerSafe®) or flexible tension interface (tagline) is appropriate. If required separation exceeds rigid reach: select tagline.

☐

### SELECT WORKING LENGTH AND CONFIGURATION

Choose the shortest length that provides the required separation while preserving effective guidance. Confirm colour and insert configuration appropriate to the environment.

☐

### INSPECT THE INTERFACE

Complete pre-use inspection: shaft, head attachment, inserts, handle security, guard condition, fasteners. Remove from service if structural integrity is uncertain.

☐

### CONDUCT THE LIFT

Apply guidance from the established working position. Accompany the operation. Reassess continuously as conditions change.

☐

### WITHDRAW

Remove the interface before the load reaches full support. Withdraw from the closing hazard zone before final landing.

☐

### REVIEW THE OPERATION

Capture any field observations. Note where guidance was effective and where the working position, interface length or method could be improved for future lifts.

## APPENDIX — QUICK ENGINEERING SELECTION GUIDE

## Engineering Selection at a Glance

This reference table condenses the complete methodology into a single field guide. For detailed guidance on each geometry or decision, refer to the chapter indicated.

TABLE 12.2 — QUICK ENGINEERING SELECTION GUIDE

| LOAD GEOMETRY      | PRIMARY GUIDANCE OBJECTIVE                                   | PREFERRED INTERFACE                                  | TYPICAL WORKING LENGTH                                | REFERENCE              |
|--------------------|--------------------------------------------------------------|------------------------------------------------------|-------------------------------------------------------|------------------------|
| Rectangular        | Maintain orientation; prevent rotation; control at landing   | Rigid                                                | 42 in – 5 ft depending on load size                   | Ch 11 §11.2            |
| Cylindrical        | Anticipate and control rolling; manage rotation continuously | Rigid (tangent contact)                              | 42 in – 4 ft; match load diameter                     | Ch 11 §11.3            |
| Long load          | Manage end sweep; allow for delayed response                 | Rigid (end contact preferred) or tagline for transit | 5 ft – 8 ft or tagline for transit                    | Ch 11 §11.4            |
| Thin plate         | Resist wind-driven rotation; manage sail effect              | Tagline preferred in wind; rigid for landing         | Tagline transit; rigid 42 in – 6 ft for landing       | Ch 11 §11.5            |
| Irregular          | Anticipate CoG rotation; correct immediately at lift-off     | Rigid (structural frame contact)                     | 42 in – 5 ft; position relative to CoG offset         | Ch 11 §11.6            |
| Flexible assembly  | Guide outer assembly; accommodate internal movement          | Rigid (outer face) or tagline                        | 4 ft – 8 ft; outer bundle contact                     | Ch 11 §11.7            |
| Sling-supported    | Manage settling; accommodate geometry change mid-lift        | Tagline preferred; rigid if sling permits            | Tagline; or rigid above sling zone                    | Ch 11 §11.9            |
| Limited contact    | Guide from identified safe zones only                        | Rigid (safe zones) or tagline if no contact possible | Match required separation; shortest providing control | Ch 11 §11.10           |
| High-precision     | Fine positional correction; maximum landing control          | Rigid; precision favours shorter lengths             | 21 in – 3 ft for final positioning                    | Ch 11 §11.8            |
| Beyond rigid reach | Swing and rotation management during transit                 | Tagline (flexible tension)                           | N/A — tagline length determined by separation         | Ch 9 §9.5, Ch 10 §10.4 |

### HOW TO USE THIS TABLE

This table provides engineering starting points, not prescriptions. The required separation established during lift planning always takes precedence over typical working lengths. If the load geometry matches more than one row, apply the engineering assessment for the most demanding characteristic present.

For every lift: study the geometry → predict the movement → identify the contact opportunity → determine the separation → then select from this table.

*The following principles have guided the development of both this guidebook and the RiggerSafe® Engineering Method.*

- 1** Respect the rigger before redesigning the interface.
- 2** Every refinement begins with a field observation.
- 3** Engineering follows physics — not opinion.
- 4** Distance should be engineered, not improvised.
- 5** Guidance is an engineering function.
- 6** Geometry governs behaviour.
- 7** Select the interface only after understanding the task.
- 8** Simplicity improves reliability.
- 9** Professional judgement remains central to every lift.
- 10** Continuous improvement is part of engineering responsibility.

Suspended loads will always demand professional judgement.  
Engineering exists to ensure that judgement can be applied  
from the safest practical position.

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*RiggerSafe® was not created to replace the experience of the  
professional rigger. It was created to improve the interface through  
which that experience is applied.*

# NO GUIDING SUSPENDED LOADS WITHOUT A RIGGERSAFE®.

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Engineer the task.

Predict the movement.

Maintain the separation.

Guide the load.

Protect the hands.

PUBLICATION DETAILS

Chapter 12 — Publication Record

TABLE 12.3 — FIGURES AND TABLES INDEX

| REFERENCE   | TITLE                                                            | PAGE |
|-------------|------------------------------------------------------------------|------|
| Figure 12.1 | The RiggerSafe® Engineering Method™ — complete decision sequence | 03   |
| Table 12.1  | RiggerSafe® engineering specification reference                  | 06   |
| Table 12.2  | Quick engineering selection guide                                | 10   |
| Table 12.3  | Figures and tables index (this table)                            | 14   |

GENERAL NOTES AND LIMITATIONS

This publication has been prepared by PSC Hand Safety India Private Limited. It represents the engineering methodology underlying the RiggerSafe® product family and the principles that guided its development. It is intended as an engineering reference for lifting teams, safety engineers, trainers and procurement professionals.

This guidebook does not constitute a regulatory requirement, a substitute for a lifting plan prepared by a competent person, or a replacement for site-specific risk assessment. The engineering principles described are applicable across industrial lifting environments but must be applied with reference to local regulations, site rules and the specific conditions of each task.

Part numbers, specifications and product information are correct at the time of publication and may be subject to change. Verify current product information with PSC Hand Safety or at [pschandsafety.com](https://pschandsafety.com) before procurement.

THE RIGGERSAFE® GUIDEBOOK — PUBLISHED CHAPTERS

|                                                                                     |                                                                     |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| Chapter 1 — Why Hands-Off Suspended Load Guidance Requires an Engineering Framework | Chapter 7 — Selecting the Appropriate Engineered Control Interface  |
| Chapter 2 — Why Workers Reach for Suspended Loads                                   | Chapter 8 — The Evolution of RiggerSafe®                            |
| Chapter 3 — How Suspended Loads Behave                                              | Chapter 9 — Engineering the Space Around a Suspended Load           |
| Chapter 4 — Engineering Principles for Hands-Free Guidance                          | Chapter 10 — Selecting the Appropriate RiggerSafe® Interface        |
| Chapter 5 — From Pick-Up to Final Placement                                         | Chapter 11 — Engineering Different Load Geometries                  |
| Chapter 6 — The Engineering Objectives of Suspended Load Guidance                   | <b>Chapter 12 — Implementing the RiggerSafe® Engineering Method</b> |

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## THE RIGGERSAFE® GUIDEBOOK

A Practical Guide to Reducing Hand Exposure During Suspended Load Operations

Professional suspended load guidance requires more than experience alone. It requires a clear understanding of load behaviour, movement, hazard space and the engineering interfaces used to control them safely.

The RiggerSafe® Guidebook presents a structured framework for reducing unnecessary hand exposure during suspended load operations — combining practical rigging knowledge with engineered guidance methods developed through industrial application.

### INSIDE THIS GUIDEBOOK

- Principles of suspended load guidance
- Load movement and movement envelopes
- Fall zones, working positions and closing hazards
- The RiggerSafe® Engineering Method™
- Working length selection
- Guidance for common load geometries
- Product specifications and inspection practices
- Implementation guidance and checklist

### DEVELOPED FOR

PROFESSIONAL RIGGERS

CRANE OPERATORS

LIFTING SUPERVISORS

APPOINTED PERSONS

SITE SAFETY PROFESSIONALS

LIFT PLANNING ENGINEERS

HEAVY INDUSTRY OPERATIONS

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*Respect the craft. Improve the interface.*