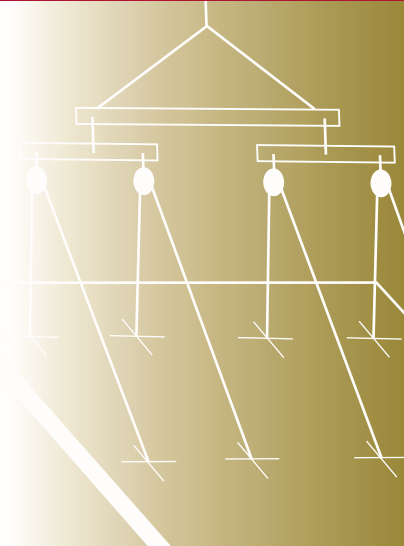


CCAA T55
CIA Z10

Guide

Guide to Tilt-up Design and Construction



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**Cement Concrete & Aggregates Australia
Concrete Institute of Australia**

CCAA T55
CIA Z10

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Concrete Institute of Australia
ABN 25 000 715 453

CIA NATIONAL OFFICE:

Level 6, 504 Pacific Highway
St Leonards NSW Australia 2065

POSTAL ADDRESS:

PO Box 848
Crows Nest NSW 1585

TELEPHONE: (61 2) 9903 7770

FACSIMILE: (61 2) 9437 9703

EMAIL: exec@coninst.com.au

NEW SOUTH WALES BRANCH:

Level 6, 504 Pacific Highway
St Leonards NSW 2065

POSTAL ADDRESS:

PO Box 848
Crows Nest NSW 1585

TELEPHONE: (61 2) 9903 7770

FACSIMILE: (61 2) 9437 9703

EMAIL: nsw@coninst.com.au

QUEENSLAND BRANCH:

Level 14
348 Edward Street
Brisbane QLD 4000

TELEPHONE: (61 7) 3227 5204

FACSIMILE: (61 7) 3839 6005

EMAIL: lynda@ccaa.com.au

VICTORIA BRANCH:

2nd Floor
1 Hobson Street
South Yarra VIC 3141

TELEPHONE: (61 3) 9804 7834

FACSIMILE: (61 3) 9827 6346

EMAIL: ciavic@coninst.com.au

WESTERN AUSTRALIA BRANCH:

45 Ventnor Avenue
West Perth WA 6005

TELEPHONE: (61 8) 9389 4447

FACSIMILE: (61 8) 9389 4451

EMAIL: wa@coninst.com.au

SOUTH AUSTRALIA BRANCH:

PO Box 148
Kent Town SA 5071

TELEPHONE: (61 8) 8300 0300

FACSIMILE: (61 8) 8341 1591

EMAIL: sa@coninst.com.au

TASMANIA BRANCH:

2 Davey Street
Hobart TAS 7000

TELEPHONE: (61 3) 6221 3715

FACSIMILE: (61 3) 6224 2325

EMAIL: tas@coninst.com.au

WEBSITE: www.coninst.com.au



Cement Concrete & Aggregates Australia is a not-for-profit organisation established in 1928 and committed to serving the Australian construction community.

CCA is acknowledged nationally and internationally as Australia's foremost cement and concrete information body – taking a leading role in education and training, research and development, technical information and advisory services, and being a significant contributor to the preparation of Codes and Standards affecting building and building materials.

CCA's principal aims are to protect and extend the uses of cement, concrete and cement-based products by advancing knowledge, skill and professionalism in Australian concrete construction and by promoting continual awareness of products, their energy-efficient properties and their uses, and of the contribution the industry makes towards a better environment.

Cement Concrete & Aggregates Australia
ABN 34 000 020 486

CCAA OFFICES

SYDNEY OFFICE:

Level 6, 504 Pacific Highway
St Leonards NSW Australia 2065

POSTAL ADDRESS:

Locked Bag 2010
St Leonards NSW 1590

TELEPHONE: (61 2) 9437 9711

FACSIMILE: (61 2) 9437 9470

BRISBANE OFFICE:

Level 14, IBM Building
348 Edward Street
Brisbane QLD 4000

TELEPHONE: (61 7) 3831 3288

FACSIMILE: (61 7) 3839 6005

EXTRACTIVE INDUSTRIES OFFICE
375 Wickham Terrace
Brisbane QLD 4000

TELEPHONE: (61 7) 3886 1543

FACSIMILE: (61 7) 3832 3195

MELBOURNE OFFICE:

2nd Floor, 1 Hobson Street
South Yarra VIC 3141

TELEPHONE: (61 3) 9825 0200

FACSIMILE: (61 3) 9825 0222

EXTRACTIVE INDUSTRIES OFFICE
486 Albert Street
Melbourne VIC 3002

POSTAL ADDRESS:

GPO Box 4352QQ
Melbourne VIC 3001

TELEPHONE: (61 3) 8662 5333

FACSIMILE: (61 3) 8662 5358

PERTH OFFICE:

45 Ventnor Avenue
West Perth WA 6005

TELEPHONE: (61 8) 9389 4452

FACSIMILE: (61 8) 9389 4451

ADELAIDE OFFICE:

Greenhill Executive Suites
213 Greenhill Road
Eastwood SA 5063

POSTAL ADDRESS:

PO Box 229
Fullarton SA 5063

TELEPHONE: (61 8) 8274 3758

FACSIMILE: (61 8) 8373 7210

EXTRACTIVE INDUSTRIES OFFICE
Enterprise House
136 Greenhill Road
Unley SA 5061

TELEPHONE: (61 8) 8300 0180

FACSIMILE: (61 8) 8300 0001

TASMANIAN OFFICE:

EXTRACTIVE INDUSTRIES OFFICE
PO Box 59
Riverside TAS 7250

TELEPHONE: (61 3) 6330 2476

FACSIMILE: (61 3) 6330 2179

WEBSITE: www.concrete.net.au

EMAIL: info@ccaa.com.au

Preface

Reflecting the relative infancy of the tilt-up method of construction, earlier publications on the subject by Cement Concrete & Aggregates Australia (formerly Cement & Concrete Association of Australia) were partly promotional and partly devoted to the engineering design aspects of the technique. The building industry has subsequently become familiar with tilt-up construction and its benefits, while designers have adopted various approaches to the specific engineering issues the method raises. Furthermore – in response to a small number of failures and their consequences that highlighted the need for appropriate consideration of safety matters – various States have introduced recommended practices for tilt-up construction¹, while an Australian Standard (AS 3850²) has also been published.

A new approach has therefore been adopted for this Guide. Whilst it replaces the *Tilt-up Construction Notes*³ and the Concrete Institute of Australia's Recommended Practice⁴, it has a different emphasis. The target audience is engineering designers – although some information on finishes and the range of building types for which tilt-up is suitable is included. (Note that this Guide is generally aimed at single-storey structures though some of the principles and details will apply to the use of the method in multi-storey buildings. However, these buildings will require consideration of a number of issues not covered by this Guide). An 'issues-based' approach has been adopted and the Guide therefore, seeks to comment only on matters that are peculiar to the design of tilt-up construction. In suggesting an overall design approach and then discussing specific issues it will alert designers to those issues that may be significant for their particular project. It does not purport to be a comprehensive manual covering all aspects of design and construction.

While construction issues will affect the design of tilt-up panels, this Guide is not aimed at construction personnel. Certain construction issues are discussed but advice provided in the various documents referred to above is not repeated.

At the time of writing, AS 3600⁵ was being revised and it was deemed prudent for this Guide to anticipate the adoption of the revised provisions in the Public Review draft of that Standard, even though they have not yet been adopted. Significant amendments are listed in the Public Review draft for the design of walls, including design for fire resistance.

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01 Introduction

1.1 General

Tilt-up is a form of construction ideally suited to the rapid realisation of a wide range of buildings for industrial, commercial, residential and community use. It provides the benefits of solid concrete-walled buildings quickly and economically.

There has been some confusion in the terminology used for 'tilt-up', eg it has been referred to as 'tilt-slab construction'. In this Guide the definition given in AS 3850 is adopted, ie *'Tilt-up panel—an essentially flat concrete panel; cast in a horizontal position, usually on-site; initially lifted by rotation about one edge until in a vertical or near-vertical position; transported and lifted into position if necessary; and then stabilized by bracing members until incorporated into the final structure.'* This definition covers panels cast on-site and those cast off-site; clearly identifies the salient features of tilt-up; and some of the necessary design considerations, eg design for lifting and design for the braced condition.

The system requires: a suitable casting bed (the slab-on-ground floor of the building is often used); simple edge formwork and basic reinforcement; suitable cranes and lifting inserts; and fixings. As the concrete placement is simply accomplished at or near ground level, traditional finishing techniques for pavement work can be employed. When the panels are cast on site, they are often cast one on top of the other (stack cast) to limit the space needed and to facilitate construction access.

When the concrete has gained adequate strength, a mobile crane is used to lift and move the panels into position. They are then temporarily braced until all connections are made to incorporate them into the structure. All operations are usually completed from ground level.

Panel size can be varied, with the maximum size being limited by the capacity of the lifting equipment to be used or, for panels cast off-site, by transport limitations on their size and weight. An endless variety of shapes can be formed to incorporate windows, door openings or architectural features. A wide range of surface finishes is also available to quickly and efficiently provide the desired appearance for the external facade of the building.

The economic benefits of tilt-up construction are not achieved at the expense of quality, durability, performance or appearance. Tilt-up requires thorough

planning but results in very quick erection of solid-walled buildings, using readily available materials, tradesmen and equipment.

This Guide is aimed at single-storey structures though some of the principles and details will apply to the use of the method in multi-storey buildings. However, these buildings will require consideration of a number of issues not covered herein.

This publication is not intended to provide a complete design and construction manual; professional advice from architects and engineers should be obtained on all tilt-up projects. Tilt-up equipment suppliers can also provide valuable advice regarding fabrication, lifting and finishing of panels.

1.2 Fully exploiting tilt-up

Thorough planning is important to the success of a tilt-up project. The following are recommended:

- All members of the design/construction team should be involved in the planning process.
- Consultation should begin at the planning phase, especially with the lifting contractor as trouble-free lifting is vital to the success of the project.
- Each member of the team should be aware of the constraints inherent in the method and of the broad implications of any planning decision.
- Consideration should be given to building-in as much flexibility as possible to the proposed construction and erection sequence so that unforeseen changes (eg necessitated by changed owner requirements or availability of specific equipment) during construction can be easily accommodated.

As tilt-up panels are a form of precast construction, the general principles to achieve maximum economy and efficiently exploit precast construction are applicable. These include:

- The building should be designed specifically for this form of construction; adapting design prepared for another form of construction will usually result in inefficient use of the method.
- As far as possible, the panels should be standardised, including reinforcement, fixings and inserts.
- As many as possible of the panel's attributes should be utilised (structural, acoustic, thermal,



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