

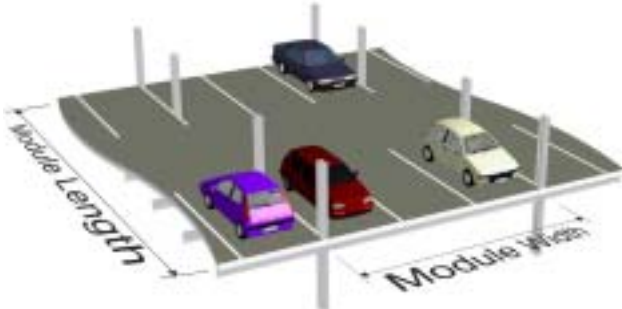












## **2. CARPARK SCHEMES AND COSTING**

### **2.1 Schemes**

Eleven carpark schemes, as shown in Figure 6, have been designed and costed. The engineering drawings for each of these schemes are given in Section 2.3.



SCHEME 1: SINGLE MODULE	SCHEME 2: SINGLE MODULE - CANTILEVER
 <p>Scheme <b>S1A</b>: 3 car spaces per module width Refer to Drawing 1A (page 11)</p>	 <p>Scheme <b>S2</b>: 3 car spaces per module width Refer to Drawing 2 (page 14)</p>
 <p>Scheme <b>S1B</b>: 4 car spaces per module width Refer to Drawing 1B (page 12)</p>	
 <p>Scheme <b>S1C</b>: 5 car spaces per module width Refer to Drawing 1C (page 13)</p>	<p><b>Figure 6 - The Eleven Carpark Schemes</b> (Contd. on next page)</p>

SCHEME 3: SINGLE MODULE	SCHEME 4: MULTIPLE MODULE	SCHEME 5: MULTIPLE MODULE - CANTILEVER
 <p>Scheme <b>S3A</b>: 2 car spaces per module width Refer to Drawing 3A (page 15)</p>	 <p>Scheme <b>S4A</b>: 3 car spaces per module width Refer to Drawing 4A (page 18)</p>	 <p>Scheme <b>S5</b>: 3 car spaces per module width Refer to Drawing 5 (page 21)</p>
 <p>Scheme <b>S3B</b>: 3 car spaces per module width Refer to Drawing 3B (page 16)</p>	 <p>Scheme <b>S4B</b>: 4 car spaces per module width Refer to Drawing 4B (page 19)</p>	
 <p>Scheme <b>S3C</b>: 4 car spaces per module width Refer to Drawing 3C (page 17)</p>	 <p>Scheme <b>S4C</b>: 5 car spaces per module width Refer to Drawing 4C (page 20)</p>	<p><b>Figure 6 (Contd.) - The Eleven Carpark Schemes</b></p>

## 2.2 Costing

The cost of each of the eleven schemes has been calculated on a square metre rate for 2, 4, 6 and 8 storey high car parks. The results are presented in Table 4.

The costing has been done on the basis of using BONDEK<sup>®</sup> profiled steel decking.

## 2.3 Engineering Drawings

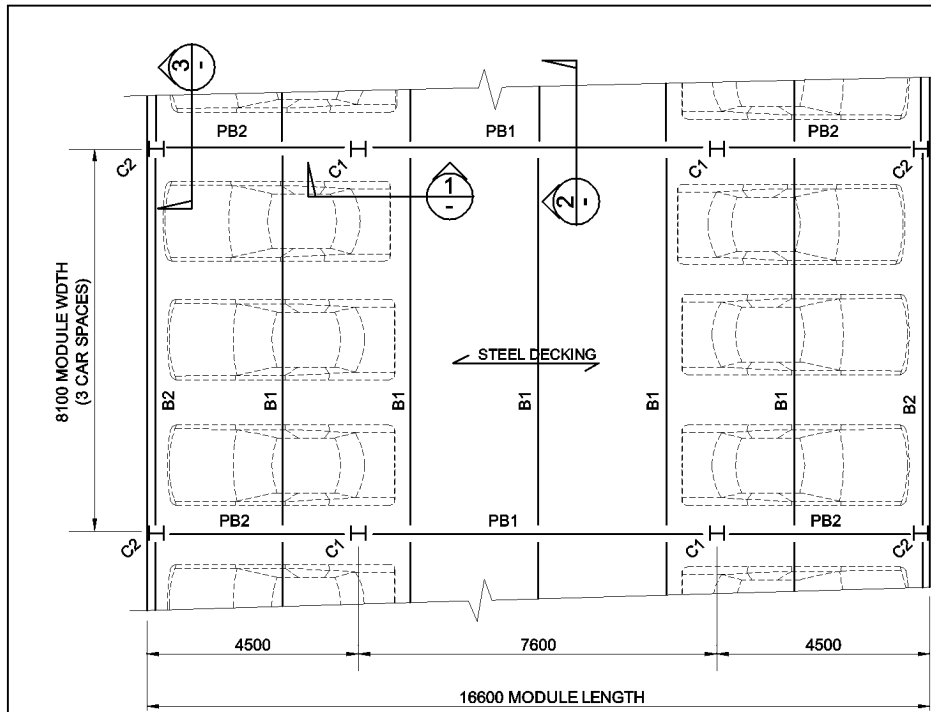
The schemes have been designed in accordance with the criteria given in Appendix A.

Scheme	Description	Floor Costs \$/m <sup>2</sup>				Column Costs \$/m <sup>2</sup> for No. of Storeys				TOTAL COST (Floor and Columns) \$/m <sup>2</sup> for No. of Storeys			
		Beams	Decking	Slab	TOTAL	2	4	6	8	2	4	6	8
<b>SINGLE MODULES</b>													
S1A	3 Spaces/Bay	83	40	55	178	12	15	17	19	190	193	195	197
S1B	4 Spaces/Bay	81	40	55	176	9	12	15	17	185	188	191	193
S1C	5 Spaces/Bay	101	40	55	195	9	12	14	17	204	207	209	212
S2	Cantilever 3 Spaces/Bay	94	40	55	189	10	11	12	15	199	200	201	204
S3A	2 Spaces/Bay	73	49	58	180	22	19	24	25	202	199	204	205
S3B	3 Spaces/Bay	132	40	55	226	8	10	12	14	234	237	239	240
S3C	4 Spaces/Bay	135	40	55	230	7	9	10	13	237	239	240	243
<b>MULTIPLE MODULES</b>													
S4A	3 Spaces/Bay	84	39	55	177	9	12	15	19	187	190	192	196
S4B	4 Spaces/Bay	80	39	55	174	8	11	15	18	182	185	189	192
S4C	5 Spaces/Bay	97	39	55	191	8	10	14	16	199	201	205	207
S5	Cantilever 3 Spaces/Bay	87	39	55	181	9	10	12	15	190	191	193	195

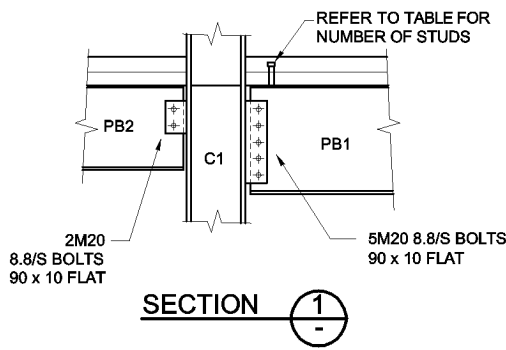
Notes:

1. The values in the table have been rounded to the nearest dollar prior to totalling
2. Costs for all schemes are based on the use of the coating system specified in Table B2 for the Atmospheric Corrosivity Category C

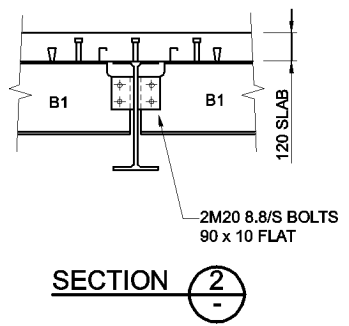
**Table 4 - Cost Summary**



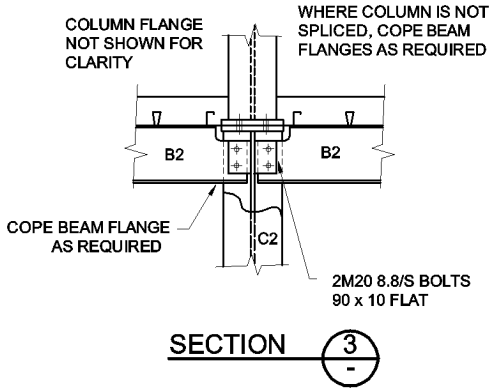
**FRAMING PLAN - TYPICAL MODULE**



**SECTION 1 - PRIMARY BEAM TO COLUMN CONNECTION**



**SECTION 2 - SECONDARY BEAM TO PRIMARY BEAM CONNECTION**



**SECTION 3 - EXTERNAL BEAM TO COLUMN CONNECTION**

- Notes
- The design conforms to AS4100-1998 & AS2327.1-1996.
  - Design Loads :  
Superimposed Dead Loads - 0.1kPa  
Live Loads - Carpark 3.0kPa (non-reducible)  
Construction Loads in accordance with Appendix F - AS2327.1-1996.
  - These designs have been based on 1.0mm Bondek II as the steel decking. Condeck HP and other profiles may also be used, however a qualified Structural Engineer shall be required to design the alternative steel decking, associated slab and variation to studs. Refer Appendix E of this guide.
  - Construction of the carpark structure, including fabrication and erection of steelwork shall comply with Section 11 of AS2327.1-1996.  
All shear studs shall be placed in the centre of the Bondek II pans where they cross the beams. Only automatically welded studs shall be applied through the Bondek II.  
The top surface of the beam shall not be treated with any material that does not allow satisfactory welding of shear studs through the steel decking.  
The beams and slabs shall not be propped.
  - All beams, columns and web side plates to be 300PLUS Steel. Base & cap plates to columns to be grade 250 AS/NZ3678-1995.
  - All welding shall be category SP in accordance with AS/NZS 1554.1-1995 unless noted otherwise.  
Welds shall be 6mm continuous fillet welds unless noted otherwise. Welding consumables shall be E48XX/W50X.
  - Lateral stability and resistance to be provided by bracing, cores and ramps.
  - Refer to Drawings C1, C2 & C3 for column details.  
Refer to Drawings S1 & S2 for slab details.

These drawings and notes have been prepared only to assist with preliminary design and budget costings. The information contained on this drawing is not intended to, and does not replace a detailed design, by appropriately qualified personnel, whose assistance and review should be sought independently. Unless required by law, no responsibility for loss damage whether consequential or otherwise resulting from the use of this information by any person is accepted.

Copyright 2002 OneSteel Manufacturing Pty Limited ABN 42 004 651 325

Beam Mark	Beam Size	No. Studs 19mm dia x 95mm high	Camber (mm)
B1	310UB40.4	20	25
B2	250UB37.3	0	25
PB1	460UB67.1	30	20
PB2	360UB44.7	0	ncu

ncu - natural camber up

Level	Column C1	Column C2
8	200UC46.2	150UC37.2
7		
6	250UC72.9	200UC46.2
5		
4	250UC89.5	250UC72.9
3		
2	310UC118	250UC89.5
1		

REV.	DATE	DESCRIPTION	DRAWN
B	May 02	Issue in DXF Format	AN
A	Oct 98	Initial Issue	AN

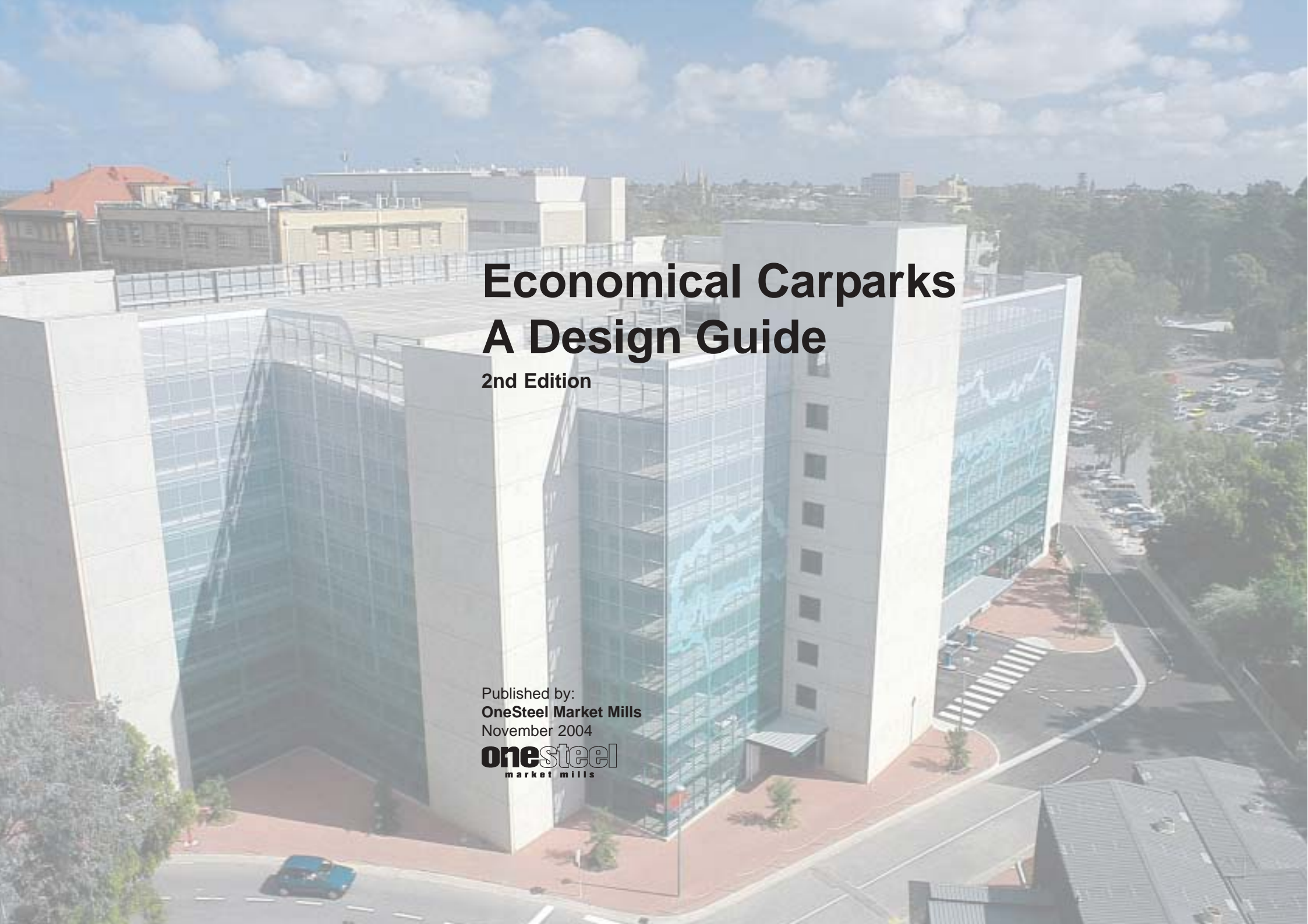
**onesteel**  
market mills

ABN 42 004 651 325      1800 1 STEEL

**Steel Carpark Design**  
**Single Module**  
**Scheme 1A - 3 car spaces / bay**

DATE OCT 98	DRAWN AN	DRAWING No. 1A	REV B
-------------	----------	----------------	-------



An aerial photograph of a modern, multi-story office building with a prominent glass facade. The building is situated in an urban environment, with other buildings and a parking lot visible in the background. The sky is blue with scattered white clouds. The text 'Economical Carparks A Design Guide' is overlaid on the image in a large, bold, black font. Below the title, '2nd Edition' is written in a smaller, black font. In the bottom right corner, the publisher information 'Published by: OneSteel Market Mills November 2004' and the 'onesteel market mills' logo are displayed.

# Economical Carparks A Design Guide

2nd Edition

Published by:  
**OneSteel Market Mills**  
November 2004

**onesteel**  
market mills



## CONTENTS

FOREWORD .....	iii
<b>1. INTRODUCTION .....</b>	<b>1</b>
<b>1.1 Steel Carparks .....</b>	<b>1</b>
<b>1.2 Layouts .....</b>	<b>2</b>
1.2.1 Column Location .....	2
1.2.2 Headroom .....	3
1.2.3 Ramps & Circulation .....	3
1.2.4 Gradients (Excluding Ramps) .....	3
<b>1.3 Parking Modules .....</b>	<b>4</b>
1.3.1 Single Module Schemes .....	5
1.3.2 Multiple Module Schemes .....	6
1.3.3 Carpark Space Utilisation Efficiency .....	6
<b>2. CARPARK SCHEMES AND COSTING .....</b>	<b>7</b>
<b>2.1 Schemes .....</b>	<b>7</b>
<b>2.2 Costing .....</b>	<b>10</b>
<b>2.3 Engineering Drawings .....</b>	<b>10</b>
<b>3. DESIGN EXAMPLES .....</b>	<b>27</b>
<b>3.1 Example 1 .....</b>	<b>29</b>
<b>3.2 Example 2 .....</b>	<b>30</b>

## APPENDICES

<b>A. STRUCTURAL DESIGN CRITERIA .....</b>	<b>32</b>
A.1 Building Regulations .....	32
A.2 Design Loads .....	32
A.3 Floors .....	32
A.4 Columns .....	34
A.5 Lateral Load Resisting Systems .....	35
A.6 Stairs .....	35
<b>B. DURABILITY .....</b>	<b>36</b>
B.1 Slabs .....	36
B.2 Profiled Steel Sheeting .....	36
B.3 Structural Steelwork .....	37
B.4 Monitoring .....	38
<b>C. FIRE RESISTANCE REQUIREMENTS .....</b>	<b>40</b>
C.1 Open-deck or Sprinklered Carparks .....	40
C.2 Not Open-deck and Not Sprinklered Carparks .....	40
<b>D. COSTING .....</b>	<b>41</b>
D.1 Methodology .....	41
D.2 Costs .....	41
D.3 Different Surface Treatment Systems .....	43
D.4 Penetrations .....	43
D.5 Column Splices .....	43
<b>E. SURVEY OF EXISTING CARPARKS .....</b>	<b>45</b>
<b>F. EXAMPLES OF RAMP     CONFIGURATIONS .....</b>	<b>52</b>