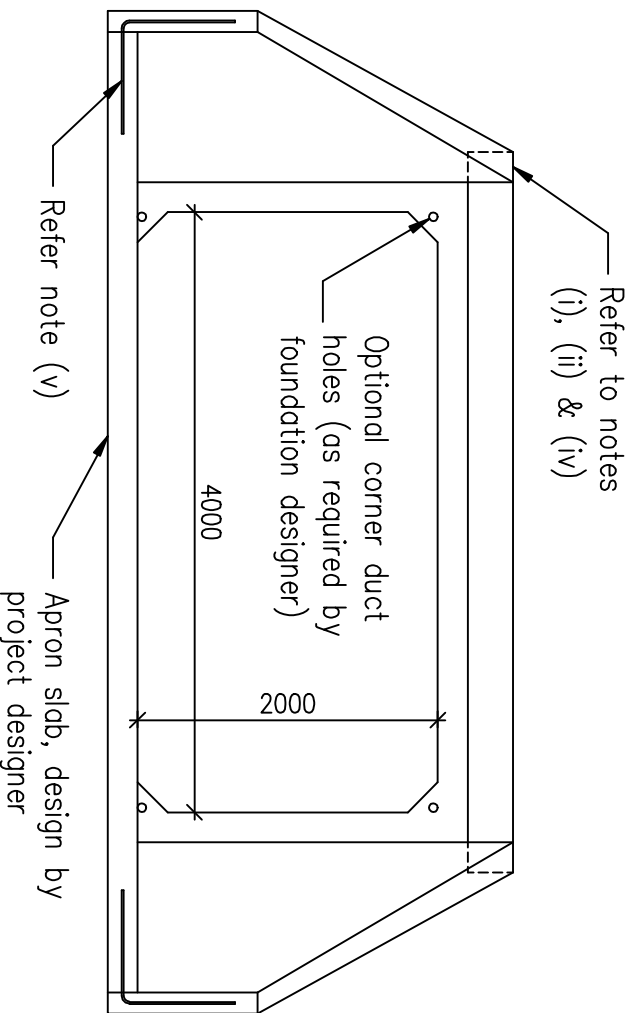


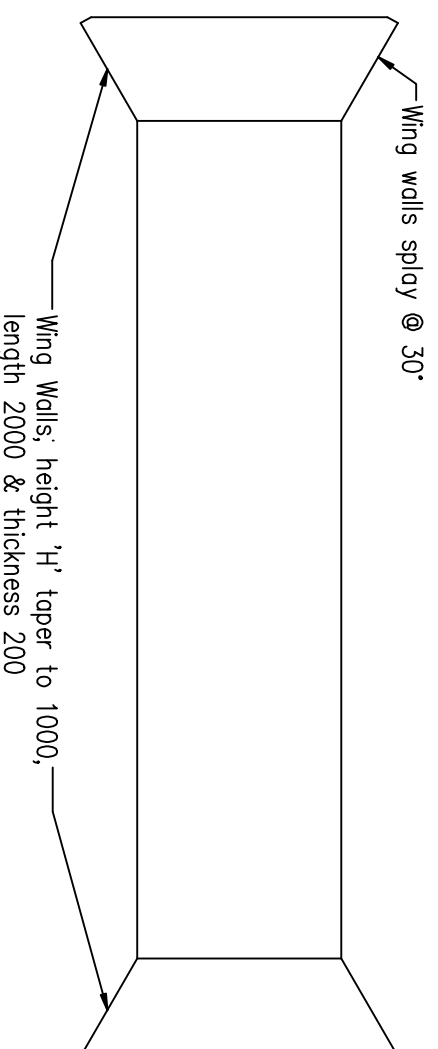
Plan

Notes:

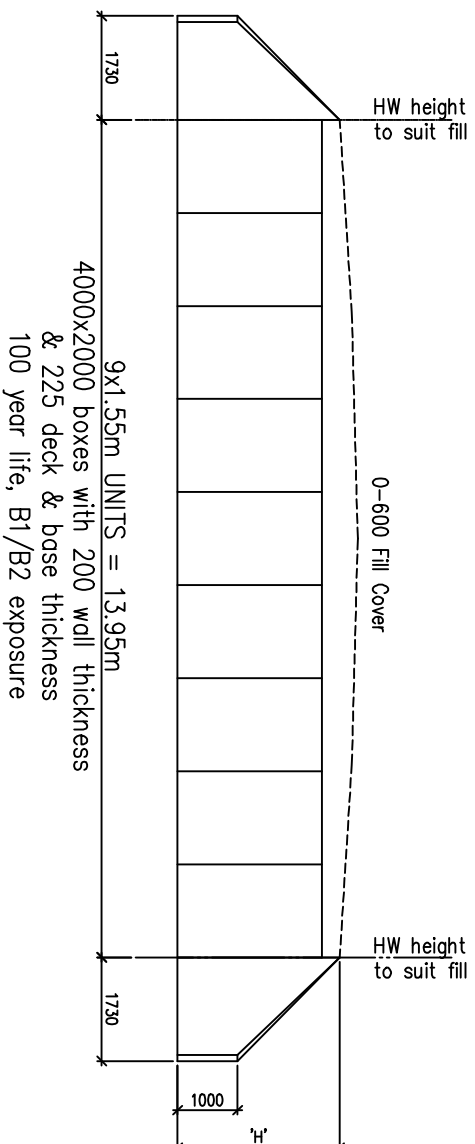
- (i) Wing Walls kinked at box wall (or angled into wall)
- (ii) Wing Walls notched at top of unit to support Head Wall
- (iii) Head Wall to Box, epoxy plus 6-HD20 dowels
- (iv) Head Wall to Wing Walls, butt and epoxy
- (v) Wing Walls to apron slab, starter bars



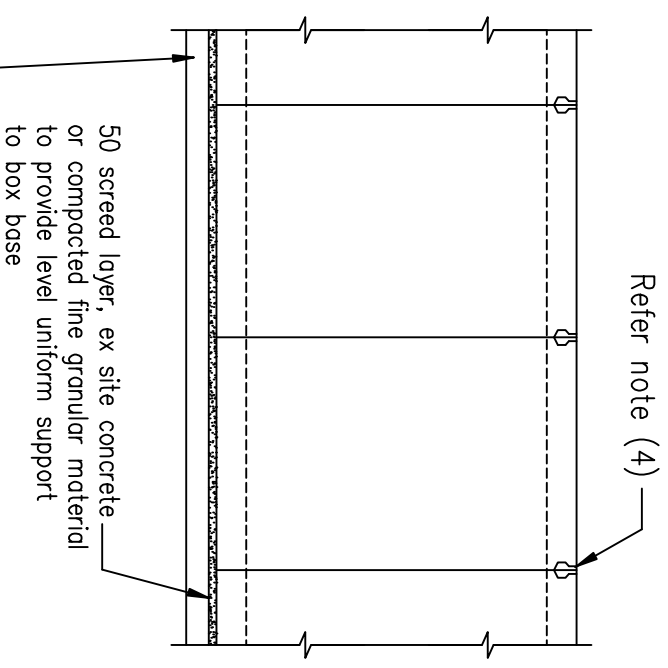
End Elevation



Plan



Side Elevation

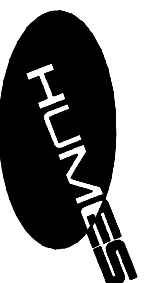


150mm compacted granular material to level, uniform foundation with minimum SBC (non factored) strength of 100kPa or as otherwise determined by the engineer to suit specific site design

Notes:

- (1) All materials to relevant regulatory specification
- (2) All construction to relevant regulatory specification
- (3) Back fill culvert sides in layers not exceeding 150mm using hand held equipment
- (4) For details of deck shear keys refer to SK200

Typical Installation Details  
(To be confirmed by project engineer)

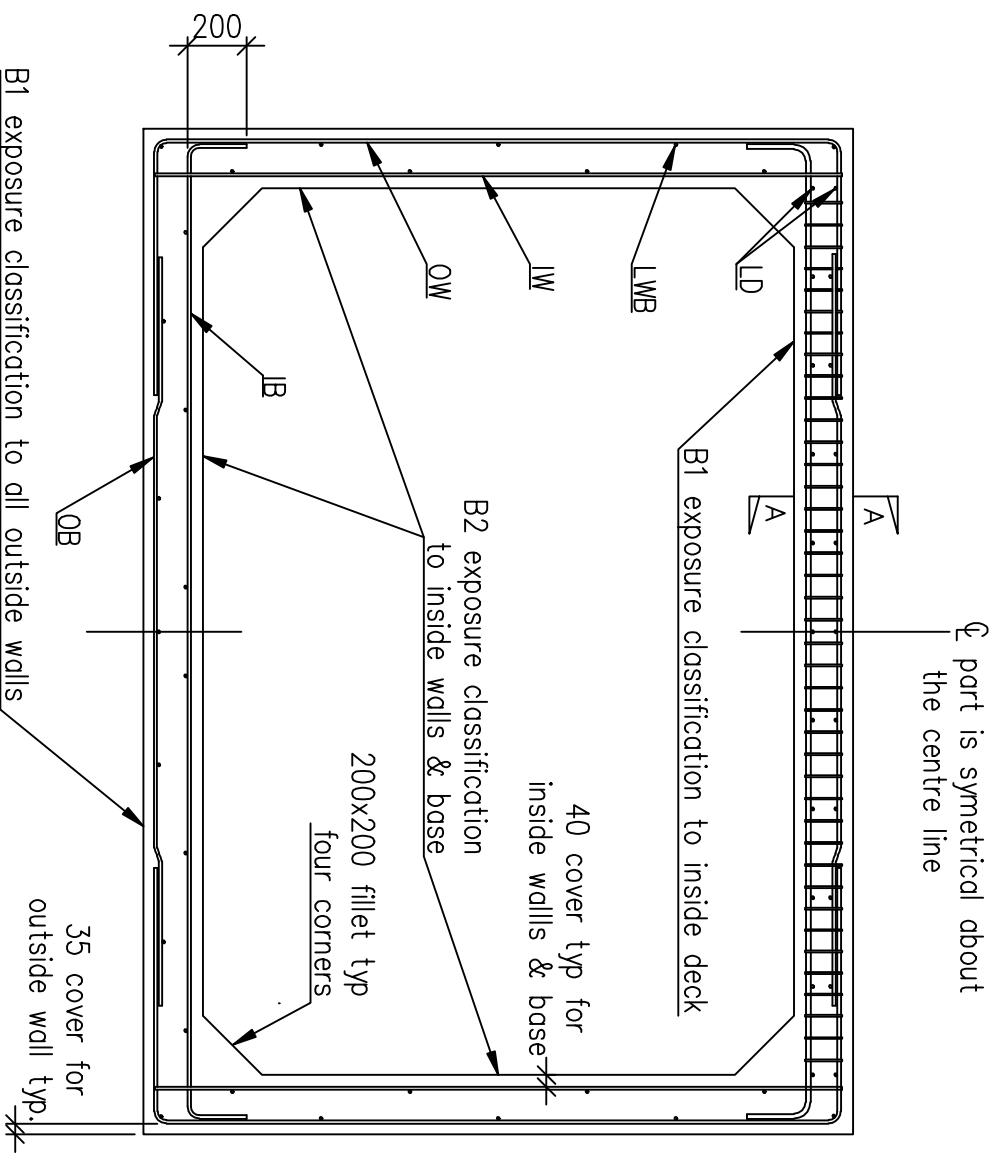


**Humes Pipeline Systems**  
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UNDERPASS BOX CULVERT  
(typical details only)  
BOX DETAILS: 9 UNITS, 4000x2000x225/200  
0-600 COVER, HN-H0-72

Drawn By	GB	Date	10-03-09
Checked By		Scale	NTS
Code No.	3845		
Drawing No.	3845-S1	Rev. No.	B

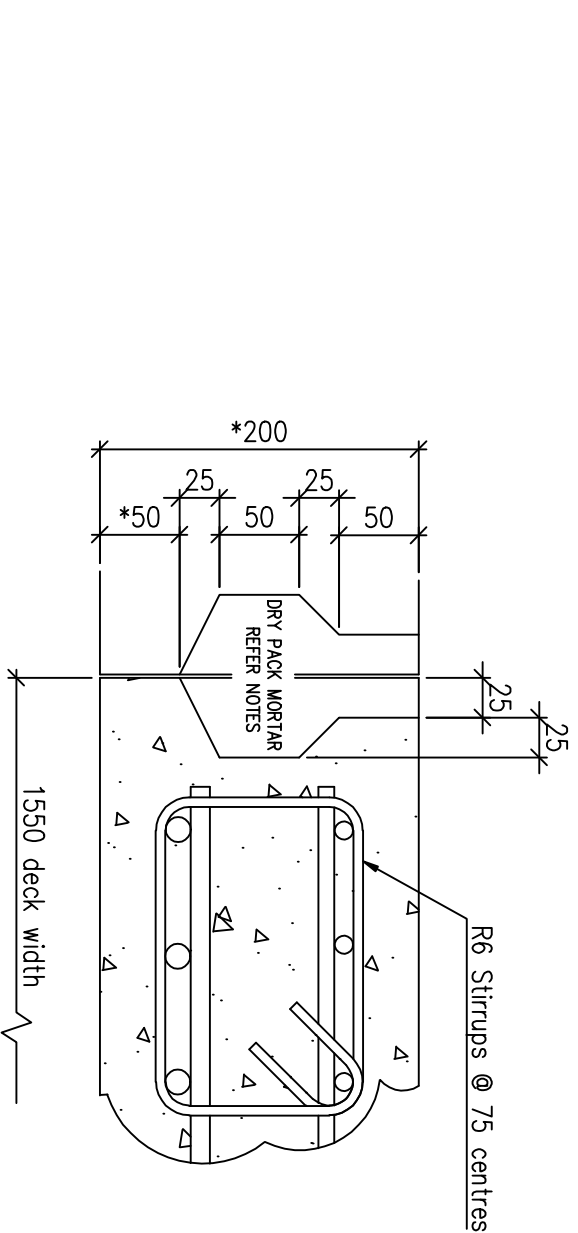
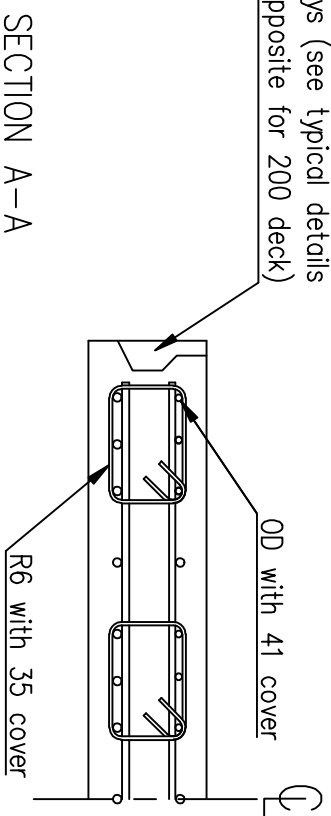
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**Reinforcing Steel**

- (1) Deck stirrup steel, R6 closed and open stirrups, Grade 300E
- (2) Flexural Steel, Grade 500E
  - ID inside deck, typically HD16 @ spacing to suit
  - IB inside base, typically HD12 @ spacing to suit
  - OW outside wall, typically HD12 @ spacing to suit
  - IW inside wall, typically HD12 @ spacing to suit
  - OD, OB outside deck and base, typically HD12 @ spacing to suit
  - LD deck distribution steel, typically HD10/HD12 pairs @ 200 centres
  - LWB wall and base longitudinal, typically HD12 @ 300 centres

Shear Keys (see typical details opposite for 200 deck)



**TYPICAL SHEAR KEY DETAILS**

**Dry pack mortar**

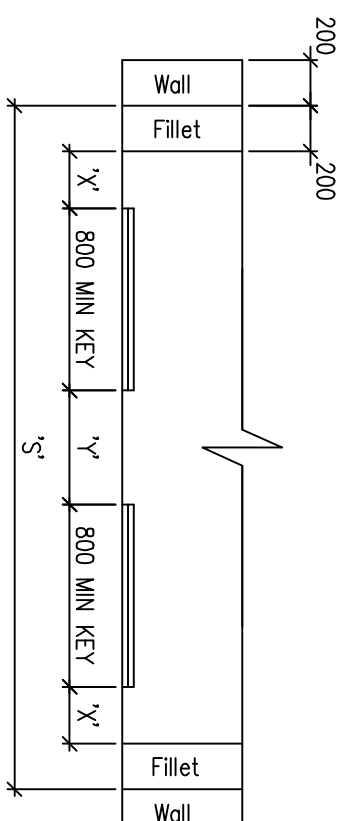
- (1) Must be applied to all keys
- (2) Sand/cement ratio 2:1
- (3) Materials and construction appropriate to sections of NZS3109
- (4) Mix dry, add water, to a mouldable mixture
- (5) Compact solidly in layers, seven days moist cure

**Sizes & position of Shear Keys in Culverts**

s	x	y
2500	100	300
3000	250	500
3500	450	600
*4000	650	*700


\* Has 225 deck/base

\* Use same profile key, 50mm to deck inside, becomes 75mm



**Notes:-**

- (1) All steel subject to specific design
- (2)  $f'c = 50MPa$  for 100 year life
- (3) Deck stirrups and shear keys required for 0-600 designs
- (4) Read in conjunction with HUMES BOX CULVERT DESIGN ASSUMPTIONS 100 YEARS



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<b>TYPICAL BOX DETAILS</b>		Drawn By	GB	Date	10-03-09
LIFE	100 YEARS	Checked By		Scale	A1
LOAD	HN - HO - 72	Reference No.			NTS
COVER	0 - 600mm	Drawing No.	SK-002	Rev. No.	B

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## Humes Pipeline Systems

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## STANDARD CONCRETE BOX CULVERTS 100 Year Design Life

### Materials

- Concrete  $f_c = 50$  MPa (28 days), Steel  $f_y = 500$  MPa, Grade 500E

### Design Assumptions

- Design Loading to TRANSIT NZ Bridge Manual: HN-HO-72
- Load Factors & Combinations, Impact Factor all to TRANSIT NZ Bridge Manual. Serviceability LL factor of 1.35 applied
- Perpendicular orientation of box culverts relative to centreline of the road
- General concrete structural design to NZS 3101:Part 1:2006
- Earth Pressure - Horizontal, Min/Max at mid wall height to generate max load effects ( $K_o = 0.55$  max,  $K_o = 0.275$  min)
- All units with fill cover (up to 2000mm) designed for positive projecting embankment conditions at  $20 \text{ kN/m}^3$ . The resultant pressure is factored as an "EP".
- Compressible / Non Compressible base analysis included
- Deck shear keys provided for fill covers 0-600mm and 300-1000mm, otherwise plain butt joint all slabs
- Shear reinforcement in the deck slab ( $V_{HN} > V_c/3$ ), to NZS 3101:2006, 9.3.9
- Serviceability check (governed by fatigue stress) to NZS 3101:2006, 2.5.2 (LL factor of 1.35 applied)
- Lifting to Code of Practice for the safe Handling, Transportation and Erection of Precast Concrete (*OSH, Dept of Labour, NZ*)
- Soil Safe Bearing (non factored loads) shall exceed 100 kPa unless specific engineering foundation design is undertaken. Boxes should be placed to a screeded sand layer to ensure uniform support over the base slab
- Durability Design: (NZS3101:2006, Section 3)  
50 MPa GP Concrete  
Unless otherwise specified all 100 year "life" standard box culverts are designed for the following exposure classifications  
All outside surfaces and inside deck, B1 (35 cover to reinforcement)  
Inside walls and inside base, B2 (40 cover to reinforcement)

### Producer Statements, Calculations, Drawings, Site Specific Design

- Clarification of requirements (eg. starter bars, inserts, duct holes, etc.) to be agreed at the time of quotation/order
- If ducts are to be provided it is strongly recommended that they are grouted back after site installation, unless the contract documents specifically provide another agreed means of achieving durability design.
- Design is associated with the individual precast element only, not with the overall contract/job design (eg. installation, jointing, prestressing, post-tensioning, tie rods, jointing of wingwalls to box culverts, etc). Site specific design is not provided.
- Calculations / drawings/ standard and non standard details, all intellectual property to Humes, will not be provided
- Producer Statements will only be made available if mutually agreed at the time of quotation

### Manufacturing Standards

- Precast Units to NZS 3109:97
- Surface Finishes to NZS 3114:87 *Formed Surfaces F4 Finish*  
*Trowelled Surfaces U2 Finish*