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**BOREHOLE RECORD SHEET**

**Location Number: BH 311**

**Project Number: 110-12936**

**Project Name: Cross River Rail**

**Location: Brisbane**

**Client: AECOM**

**Date: 18/01/2012**

**Page: 1 OF 5**

Easting: 503257      Northing: 6960948      RL: -10.70 m  
Logger: CS/DT      Operator: SO      Machine: Scout 2

Drilling Method				Depth	Graphic	Description	Weathering	Strength Estimated	Defect Spacing	Rec (%)	RQD	Samples and Remarks
TC	WB	RR	Casing									
				1.0		Clayey SAND (SC) Very loose, fine grained, dark grey and black.						
				2.0								
				3.0								
				4.0								
				5.0								
				5.20								
				6.0		Gravelly SAND (SP) Medium dense, fine to medium grained, brown and black, with traces of white.						
				7.0								
				8.0								
				8.50								
				9.0		Silty SAND (SM) Loose, medium grained, black and brown, trace of gravel.						
				10.0								

**Comments:**

1) Drilled from floating barge - all depths measured from river bed level. 2) Note: the coring method used was NQ3 not NMLC. 3) Borehole grouted on completion.

Water First Noted      Water Steady Level

**Defects - 1.54m : F,60° P,R,O,C**

Depth (m)	Type	Dip (deg)	Planarity	Roughness	Aperture	Width
	B - Bedding		C - Curvilinear	L - Slickensides	C - Closed	C - Clay
	C - Clay seam		D - Discontinuous	P - Polished	F - Filled	F - Iron Oxide
	F - Foliation		P - Planar	R - Rough	N - Clean	K - Calcite
	H - Schistosity		S - Subplanar	S - Smooth	O - Open	L - Limonite
	J - Joint		T - Stepped	V - Very rough	S - Stain	Q - Quartz
	L - Cleavage		U - Undulating			S - Secondary mineral
	R - Fracture					U - Unidentified mineral
	S - Shear zone					W - Weathered rock
	T - Contact					X - Carbonaceous
	V - Vein					Z - Clean
	Z - Decomposed Zone					
	DI - Drilling induced break					

**Weathering Grades**

RS - Residual Soil  
XW - Extremely weathered  
DW - Distinctly weathered  
SW - Slightly weathered  
FR - Fresh  
**Rock Strength**  
VW - Very weak  
W - Weak  
MS - Medium strong  
S - Strong  
VS - Very strong  
ES - Extremely strong

**Samples**

U50  
SPT  
Disturbed Sample

Approved:  
Date:



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## BOREHOLE RECORD SHEET

Location Number: BH 311

Project Number: 110-12936

Project Name: Cross River Rail

Location: Brisbane

Client: AECOM

Date: 18/01/2012

Page: 2 OF 5

Easting: 503257 Northing: 6960948 RL: -10.70 m  
Logger: CS/DT Operator: SO Machine: Scout 2

Drilling Method				Depth	Graphic	Description	Weathering	Strength Estimated rs vw w ms s vs es	Defect Spacing 20 60 200 600	Rec (%)	RQD	Samples and Remarks
TC	WB	RR	NM/LC									
				11.0		Silty SAND (SM) Loose, medium grained, black and brown, trace of gravel. (continued)						
				12.0								
				12.40								
				13.0		GRAVEL (GP) Medium dense, medium to coarse size, grey and black and yellow.						
				14.0								
				14.60								
				15.0		COBBLES and GRAVEL						
				15.20								
				16.0		CORE LOSS 1.40m (15.20-16.60)				30	0	
				16.60								
				17.0		CONGLOMERATE, coarse grained, pale grey speckled dark grey, medium bedded, very closely spaced to moderately widely spaced fractures. Clasts are subrounded, medium grained of siltstone, sandstone, quartz and tuff, with medium grained sandstone band from 17.08m to 17.30m. Clast supported.	FR					16.86 m; DI, 5°, S, R, O, Z 17.12 m; B, 25°, P, R, O, Z 17.57 m; DI, 5°, S, R, O, Z 17.76 m; DI, 5°, S, R, O, Z 18.10 m; DI, 2°, S, R, O, Z 18.48 m; DI, 18°, S, R, O, Z
				18.0						100	87	
				18.70								18.77 m; V, 11°, P, S, O, X 18.84 m; V, 10°, P, S, O, X 18.95 m; B, 10°, P, R, O, Z 18.98 m; J, 25°, P, R, O, Z 19.07 m; B, 18°, P, R, O, Z 19.21 m; B, 10°, P, R, O, Z
				19.0		SANDSTONE, medium grained, pale grey, thinly bedded, closely spaced fractures, with medium sized gravel from 19.25m to 19.30m. Trace of coal.						
				19.30						100	0	
				20.0		SANDSTONE, coarse grained, pale grey, thin to medium bedding, moderately widely spaced fractures, grades into fine grained conglomerate from 20.10m to 20.39m.				100	83	19.95m, Is50 = 1.43 MPa

### Comments:

1) Drilled from floating barge - all depths measured from river bed level. 2) Note: the coring method used was NQ3 not NM/LC. 3) Borehole grouted on completion.

Water First Noted Water Steady Level

### Defects - 1.54m : F,60° P,R,O,C

Depth (m)	Type	Dip (deg)	Planarity	Roughness	Aperture	Fill
	B - Bedding		C - Curvilinear	L - Slickensides	C - Closed	C - Clay
	C - Clay seam		D - Discontinuous	P - Polished	F - Filled	F - Iron Oxide
	F - Foliation		P - Planar	R - Rough	N - Clean	K - Calcite
	H - Schistosity		S - Subplanar	S - Smooth	O - Open	L - Limonite
	J - Joint		T - Stepped	V - Very rough	S - Stain	Q - Quartz
	L - Cleavage		U - Undulating			S - Secondary mineral
	R - Fracture					U - Unidentified mineral
	S - Shear zone					W - Weathered rock
	T - Contact					X - Carbonaceous
	V - Vein					Z - Clean
	Z - Decomposed Zone					
	DI - Drilling induced break					

### Weathering Grades

RS - Residual Soil  
XW - Extremely weathered  
DW - Distinctly weathered  
SW - Slightly weathered  
FR - Fresh  
Rock Strength  
VW - Very weak  
W - Weak  
MS - Medium strong  
S - Strong  
VS - Very strong  
ES - Extremely strong

### Samples

U50  
SPT  
Disturbed Sample

Approved:  
Date:



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## BOREHOLE RECORD SHEET

Location Number: BH 311

Project Number: 110-12936

Project Name: Cross River Rail

Location: Brisbane

Client: AECOM

Date: 18/01/2012

Easting: 503257 Northing: 6960948 RL: -10.70 m

Logger: CS/DT Operator: SO Machine: Scout 2

Page: 3 OF 5

Drilling Method				Depth	Graphic	Description	Weathering	Strength Estimated	Defect Spacing	Rec (%)	RQD	Samples and Remarks
TC	WB	RR	NMLC									
				20.39		CONGLOMERATE, coarse grained, pale grey speckled dark grey, medium bedded, closely to moderately widely spaced fractures. Clasts are fine gravel sized, with some medium to coarse gravel of siltstone, sandstone, quartz and tuff. Clast supported.	FR					
				21.0						100	83	21.1m, Is50 = 0.69 MPa 21.25m, Is50 = 0.56 MPa
				22.0								
				23.0						100	91	
				24.0								
				25.0		SANDSTONE, coarse grained, pale grey, thin to medium bedding, closely spaced fractures.						24.57 m; J, 40°, P, S, O, Z 19.86-29.32 m; DI, 3 - 10°, S, R, O, Z 24.9m, Is50 = 1.33 MPa
				25.76								25.5m, Is50 = 3.48 MPa
				26.0								26.1m, Is50 = 0.35 MPa 26.15 m; J, 30°, S, R, O, Z
				26.05						100	90	
				27.0								28.29m, Is50 = 3.3 MPa 28.19 m; J, 23°, P, R, O, Z 28.4m, Is50 = 2.53 MPa 28.50 m; J, 40°, P, R, O, Z
				28.0		CONGLOMERATE, coarse grained, pale grey speckled dark grey, medium bedded, moderately widely spaced fractures. Clasts are fine gravel sized, with some medium to coarse gravel of siltstone, sandstone, quartz and tuff. Clast supported.						
				28.75						100	86	29.25m, Is50 = 3.36 MPa
				29.0								
				30.0								

### Comments:

1) Drilled from floating barge - all depths measured from river bed level. 2) Note: the coring method used was NQ3 not NMLC. 3) Borehole grouted on completion.

Water First Noted Water Steady Level

### Defects - 1.54m : F, 60°, P, R, O, C

Depth (m)	Type	Dip (deg)	Planarity	Roughness	Aperture	Fill
	B - Bedding		C - Curvilinear	L - Slickensides	C - Closed	C - Clay
	C - Clay seam		D - Discontinuous	P - Polished	F - Filled	P - Iron Oxide
	F - Foliation		P - Planar	R - Rough	N - Clean	K - Calcite
	H - Schistosity		S - Subplanar	S - Smooth	O - Open	L - Limonite
	J - Joint		T - Stepped	V - Very rough	S - Silty	Q - Quartz
	L - Cleavage		U - Undulating			S - Secondary mineral
	R - Fracture					U - Unidentified mineral
	S - Shear zone					W - Weathered rock
	T - Contact					X - Carbonaceous
	V - Vein					Z - Clean
	Z - Decomposed Zone					
	DI - Drilling induced break					

### Weathering Grades

RS - Residual Soil
XW - Extremely weathered
DW - Distinctly weathered
SW - Slightly weathered
FR - Fresh
Rock Strength
VW - Very weak
W - Weak
MS - Medium strong
S - Strong
VS - Very strong
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### Samples

U50
SPT
Disturbed Sample

Approved:  
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## BOREHOLE RECORD SHEET

Location Number: BH 311

Project Number: 110-12936

Project Name: Cross River Rail

Location: Brisbane

Client: AECOM

Date: 18/01/2012

Page: 4 OF 5

Easting: 503257 Northing: 6960948 RL: -10.70 m  
Logger: CS/DT Operator: SO Machine: Scout 2

Drilling Method				Depth	Graphic	Description	Weathering	Strength Estimated	Defect Spacing	Rec (%)	RQD	Samples and Remarks
TC	WB	RR	NMLC									
				30.07		Interbedded SANDSTONE and SILTSTONE, fine grained, alternating pale grey and dark grey, granular, typically medium bedded with some thin laminations, very closely spaced to moderately widely spaced fractures. Some faulting from 31.0m to 31.70m.	FR					30.22 m; J, 63°, P, S, O, Z 30.59m, Is50 = 2.89 MPa 30.93 m; J, 75°, C, R, O, Z
				31.0						100	86	31.18 m; J, 62°, P, R, O, Z 31.27 m; S, 3°, P, S, C, Z 31.36 m; S, 10°, P, S, C, Z 31.43 m; S, 10°, P, S, C, Z 31.49 m; S, 15°, P, S, C, Z 31.56 m; S, 37°, P, S, C, Z 31.59 m; S, 40°, P, S, C, Z 31.70 m; S, 25°, P, S, C, Z 31.76 m; J, 45°, C, R, O, Z 32.08m, Is50 = 2.08 MPa
				32.0								
				32.70		SILTSTONE, fine grained, alternating dark grey and grey, thinly laminated, extremely closely spaced to widely spaced fractures, with some sandstone interlamination. Some faulting from 39.64m to 41.5m. Trace slickensides.				100	88	32.63 m; J, 32°, U, S, O, Z 33.40 m; V, 40°, P, S, C, Q
				33.0								
				34.0								
				35.0								34.6m, Is50 = 3.12 MPa 34.72m, Is50 = 0.12 MPa
				36.0						100	100	30.13-41.21 m; B, 1 - 9°, P, S, O, Z 36.39m, Is50 = 0.65 MPa 36.31 m; V, 3°, D, S, C, Q 36.5m, Is50 = 1.4 MPa
				37.0								37.05m, Is50 = MPa 37.2m, Is50 = 0.49 MPa
				38.0								
				39.0						100	66	38.49m, Is50 = 1.13 MPa 39.38 m; J, 45°, S, R, O, Z 39.61 m; S, 16°, P, S, O, Z 39.77 m; V, 9°, P, R, C, Q 39.81 m; B, 15°, P, L, O, Z
				40.0								

### Comments:

1) Drilled from floating barge - all depths measured from river bed level. 2) Note: the coring method used was NQ3 not NMLC. 3) Borehole grouted on completion.

Water First Noted Water Steady Level

Defects - 1.54m : F, 60°, P, R, O, C											
Depth (m)	Type	Dip (deg)	Planarity	Roughness	Aperture	Fill	Weathering	Strength	Defect	Spacing	Remarks
	B - Bedding		C - Curvilinear	L - Slickensides	C - Closed	F - Filled	FR - Fresh	VS - Very strong			
	C - Clay seam		D - Discontinuous	P - Polished	F - Filled	F - Filled	DW - Distinctly weathered	MS - Medium strong			
	F - Foliation		P - Planar	R - Rough	N - Clean	K - Calcite	SW - Slightly weathered	W - Weak			
	H - Schistosity		S - Subplanar	S - Smooth	O - Open	L - Limonite	FR - Fresh	MS - Medium strong			
	J - Joint		T - Stepped	V - Very rough	S - Stain	Q - Quartz	SW - Slightly weathered	S - Strong			
	L - Cleavage		U - Undulating			S - Secondary mineral	FR - Fresh	VS - Very strong			
	R - Fracture					U - Unidentified mineral	FR - Fresh	ES - Extremely strong			
	S - Shear zone					W - Weathered rock	FR - Fresh				
	T - Contact					Z - Carbonaceous	FR - Fresh				
	V - Vein					Z - Clean	FR - Fresh				
	Z - Decomposed zone						FR - Fresh				
	DI - Drilling induced break						FR - Fresh				

Weathering Grades	
RS - Residual Soil	
XW - Extremely weathered	
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Samples	
U50	
SPT	
Disturbed Sample	

Approved:  
Date:



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Location Number: BH 311

Project Number: 110-12936

Project Name: Cross River Rail

Location: Brisbane

Client: AECOM

Date: 18/01/2012

Easting: 503257 Northing: 6960948 RL: -10.70 m

Logger: CS/DT Operator: SO Machine: Scout 2

Page: 5 OF 5

Drilling Method					Depth	Graphic	Description	Weathering	Strength Estimated	Defect Spacing	Rec (%)	RQD	Samples and Remarks
TC	WB	RR	NM/LC	Casing									
					41.0		SILTSTONE, fine grained, alternating dark grey and grey, thinly laminated, extremely closely spaced to widely spaced fractures, with some sandstone interlamination. Some faulting from 39.64m to 41.5m. Trace slickensides. (continued)	FR			100	66	39.90 m; J, 40°, P, S, O, Z 39.93 m; V, 14°, P, S, C, Q 40.10 m; J, 87°, P, S, O, Z 40.15 m; V, 21°, P, S, C, Q 40.21 m; J, 38°, S, P, O, Z 40.27 m; J, 27°, P, S, O, Q 40.35 m; B, 80°, P, L, O, Z 40.38 m; V, 4°, P, S, C, Q 40.7m, Is50 = 0.77 MPa 40.70 m; J, 90°, P, S, C, Q 40.80 m; J, 87°, P, S, C, Q 40.98 m; V, 19°, P, S, C, Q
					41.50		BOREHOLE BH 311 TERMINATED AT 41.50 m						41.45 m; J, 78°, P, S, C, Q
					42.0								
					43.0								
					44.0								
					45.0								
					46.0								
					47.0								
					48.0								
					49.0								
					50.0								

### Comments:

1) Drilled from floating barge - all depths measured from river bed level. 2) Note: the coring method used was NQ3 not NM/LC. 3) Borehole grouted on completion.

Water First Noted Water Steady Level

Defects - 1.54m : F, 60° P, R, O, C									
Depth (m)	Type	Dip (deg)	Planarity	Roughness	Aperture	Width	Frequency	Remarks	Notes
	B - Bedding		C - Curvilinear	L - Slickensides	C - Closed	C - Clay			
	C - Clay seam		D - Discontinuous	P - Polished	F - Filled	F - Iron Oxide			
	F - Fault		P - Planar	R - Rough	N - Clean	K - Calcite			
	H - Schistosity		S - Subplanar	S - Smooth	O - Open	L - Limonite			
	J - Joint		T - Stepped	V - Very rough	S - Stain	Q - Quartz			
	L - Cleavage		U - Undulating			S - Secondary mineral			
	R - Fracture					U - Unidentified mineral			
	S - Shear zone					W - Weathered rock			
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	Z - Decomposed zone								
	DI - Drilling induced break								

Weathering Grades	
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Rock Strength	
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MS - Medium strong	
S - Strong	
VS - Very strong	
ES - Extremely strong	

Samples	
U50	
SPT	
Disturbed Sample	

Approved: Date:





TITLE

AECOM  
Brisbane  
Cross River Rail  
Core Photo - BH 311

DRAWN

DT

DATE

26/04/2012

CHECKED

CB

DATE

26/04/2012

SCALE

Not To Scale

A4

PROJECT No

110-12936

FIGURE No

1/2





TITLE

AECOM  
Brisbane  
Cross River Rail  
Core Photo - BH 311

DRAWN	DT	DATE	26/04/2012
CHECKED	CB	DATE	26/04/2012
SCALE	Not To Scale		A4
PROJECT No	110-12936	FIGURE No	2/2



## IN-SITU PACKER PERMEABILITY TEST RESULT

**PROJECT:** **CRR**      **BH No.:** **311**  
**PROJECT No.:** **110-12936**      **Test No.:** **1**  
**Date:** **19/01/2012**

Packer type: Double  
Packer pressure: 2000kPa  
Gauge pressures measured in: kPa  
Tested by: CS

Vertical depth to:  
(below river bed)

Top of test section (m):	28.00
Base of test section (m):	30.50
Centre of test section(m):	29.25
Base of casing (m):	27.00
Ground water (m)	TIDAL

Depth of centre of test section (m):	29.25
Length of test section (m):	2.50

Gauge Height above ground level (m):	
Hole Diameter in test section (mm)	75

1st period	Time (mins)	0	5	10	15	Average
Gauge Pressure 100	Flow reading	995.8	998.0	998.0	998.0	Flow (l/min)
	Water Take	0.00	2.20	0.00	0.00	0.147
2nd period	Time (mins)	0	5	10	15	Average
Gauge Pressure 200	Flow reading	1000.5	1000.8	1000.8	1000.9	Flow (l/min)
	Water Take	0.00	0.30	0.00	0.10	0.027
3rd period	Time (mins)	0	5	10	15	Average
Gauge Pressure 300	Flow reading	1003.8	1004.9	1005.5	1006.0	Flow (l/min)
	Water Take	0.00	1.10	0.60	0.50	0.147
4th period	Time (mins)	0	5	10	15	Average
Gauge Pressure 200	Flow reading	1010.0	1010.5	1012.5	1013.0	Flow (l/min)
	Water Take	0.00	0.50	2.00	0.50	0.200
5th period	Time (mins)	0	5	10	15	Average
Gauge Pressure 100	Flow reading	1013.0	1013.5	1014.0	1014.6	Flow (l/min)
	Water Take	0.00	0.00	0.50	0.60	0.073

Period	Flow (q) (l/min)	Gauge Press (kPa)	Gauge Press (m of water)	Friction Loss (m)*		Total Head (m)	Lugeon Value	Perm. (m/s)
				Basic	In extra rods			
1st	0.147	100.00	10.220	0.000	0.000	39.470	0.152	1.65E-08
2nd	0.027	200.00	20.440	0.000	0.000	49.690	0.022	2.39E-09
3rd	0.147	300.00	30.660	0.000	0.000	59.910	0.100	1.09E-08
4th	0.200	200.00	20.440	0.000	0.000	49.690	0.164	1.79E-08
5th	0.073	100.00	10.220	0.000	0.000	39.470	0.076	8.27E-09

\*Where friction loss is assumed to be negligible.

N.B. Pressure Conversion: 1 bar = 100 kPa = 14.503 psi

## IN-SITU PACKER PERMEABILITY TEST RESULT

**PROJECT:** **CRR**  
**PROJECT No.:** **110-12936**

**BH No.:** **311**  
**Test No.:** **2**  
**Date:** **19/01/2012**

Packer type: Double  
Packer pressure: 2000kPa  
Gauge pressures measured in: kPa  
Tested by: CS

Vertical depth to:  
(below river bed)

Top of test section (m):	19.00
Base of test section (m):	21.00
Centre of test section(m):	20.00
Base of casing (m):	18.00
Ground water (m)	TIDAL

Depth of centre of test section (m):	20.00
Length of test section (m):	2.00

Gauge Height above ground level (m):	
Hole Diameter in test section (mm)	75

1st period	Time (mins)	0	5	10	15	Average
Gauge Pressure 100	Flow reading	1024.5	1024.8	1025.1	1025.4	Flow (l/min)
	Water Take	0.00	0.30	0.30	0.30	0.060
2nd period	Time (mins)	0	5	10	15	Average
Gauge Pressure 200	Flow reading	1026.6	1026.8	1026.9	1027.1	Flow (l/min)
	Water Take	0.00	0.20	0.10	0.20	0.033
3rd period	Time (mins)	0	5	10	15	Average
Gauge Pressure 300	Flow reading	1027.8	1027.8	1030.0	1031.0	Flow (l/min)
	Water Take	0.00	0.00	2.20	1.00	0.213
4th period	Time (mins)	0	5	10	15	Average
Gauge Pressure 200	Flow reading	1031.0	1031.2	1032.1	1033.0	Flow (l/min)
	Water Take	0.00	0.20	0.90	0.90	0.133
5th period	Time (mins)	0	5	10	15	Average
Gauge Pressure 100	Flow reading	1033.0	1033.1	1033.3	1033.5	Flow (l/min)
	Water Take	0.00	0.00	0.20	0.20	0.027

Period	Flow (q) (l/min)	Gauge Press (kPa)	Gauge Press (m of water)	Friction Loss (m)*		Total Head (m)	Lugeon Value	Perm. (m/s)
				Basic	In extra rods			
1st	0.060	100.00	10.220	0.000	0.000	30.220	0.101	1.05E-08
2nd	0.033	200.00	20.440	0.000	0.000	40.440	0.042	4.34E-09
3rd	0.213	300.00	30.660	0.000	0.000	50.660	0.215	2.22E-08
4th	0.133	200.00	20.440	0.000	0.000	40.440	0.168	1.74E-08
5th	0.027	100.00	10.220	0.000	0.000	30.220	0.045	4.65E-09

\*Where friction loss is assumed to be negligible.

N.B. Pressure Conversion: 1 bar = 100 kPa = 14.503 psi