

The benchmark for survey and spatial solutions

Melbourne Observation Wheel

18th August 2011

Braith McClure

Manager Engineering Surveying

VEKTA



Southern Star Observation Wheel

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ORIGINAL DESIGN

- Wheel opened late December 2008
- Closed late January 2009

PROBLEMS

- Buckling and cracks
- Originally said to be due to heat stress
- Later found to be a design fault and iron chemistry
- Complex litigation underway, no further comment.



New Design

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FEATURES

- Heavier
- More flexible connections
- Better designed for motion
- Improved drive systems

COMPONENTS

- Seven inner spokes
- Seven outer spokes
- Rim and cabins (original)



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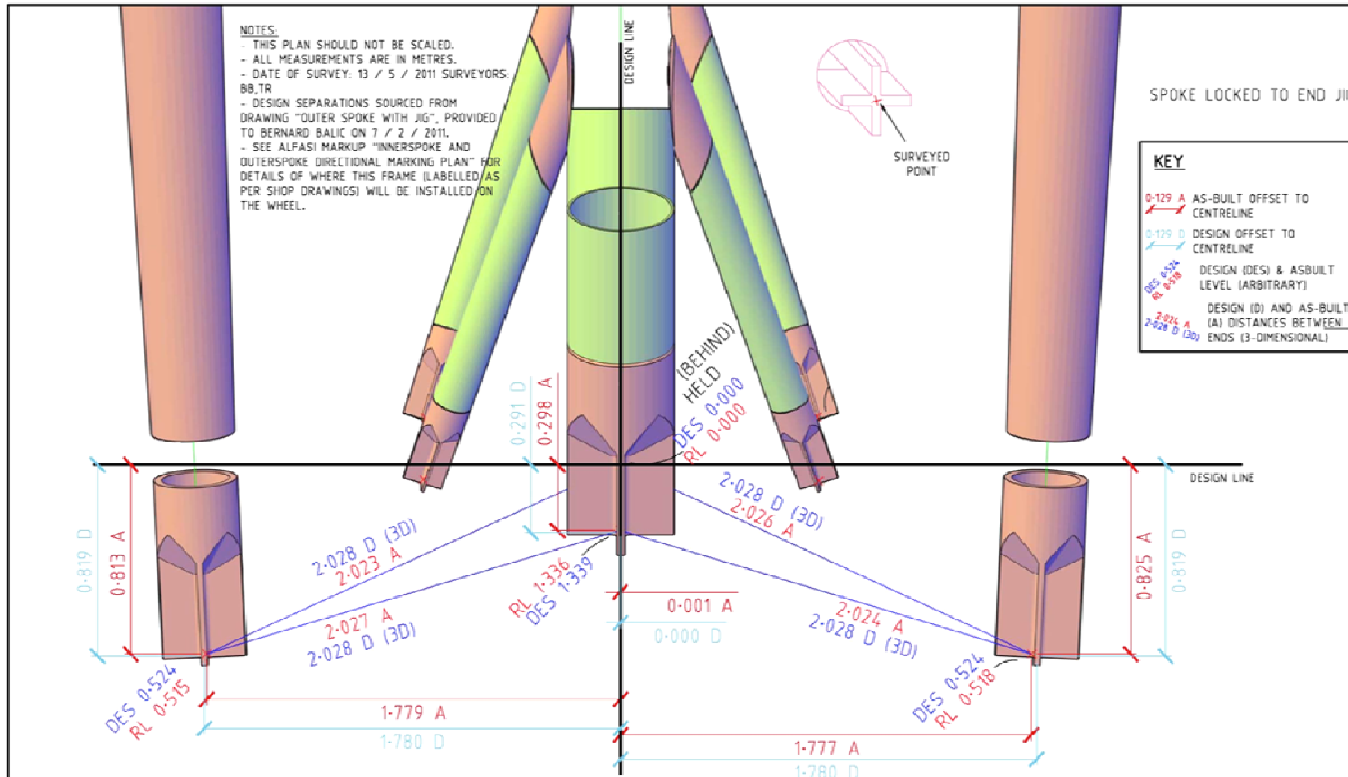
MONITORING

- Monitored the hub as the old wheel spokes were taken down (2009), removal of mass
- Vekta to monitor the wheel as it is re-constructed, mass increase and uneven loading
- Columns supporting the hub to be monitored (particularly due to the excess weight)

AS-BUILT/SETOUT – MAJORITY OF WORKS

- Checking constructed accuracy of steel members in the staging yard
- As-builts of spokes before tightening and after – offsets to design
- As-builts of yellow trusses to determine spoke twist, alignment and separation.

Yard As-Builts



H			
G			
F			
E			
D			
C			
B			
A	16/5/2011	ORIGINAL PLAN	BM
REV	DATE	COMMENTS	CKD

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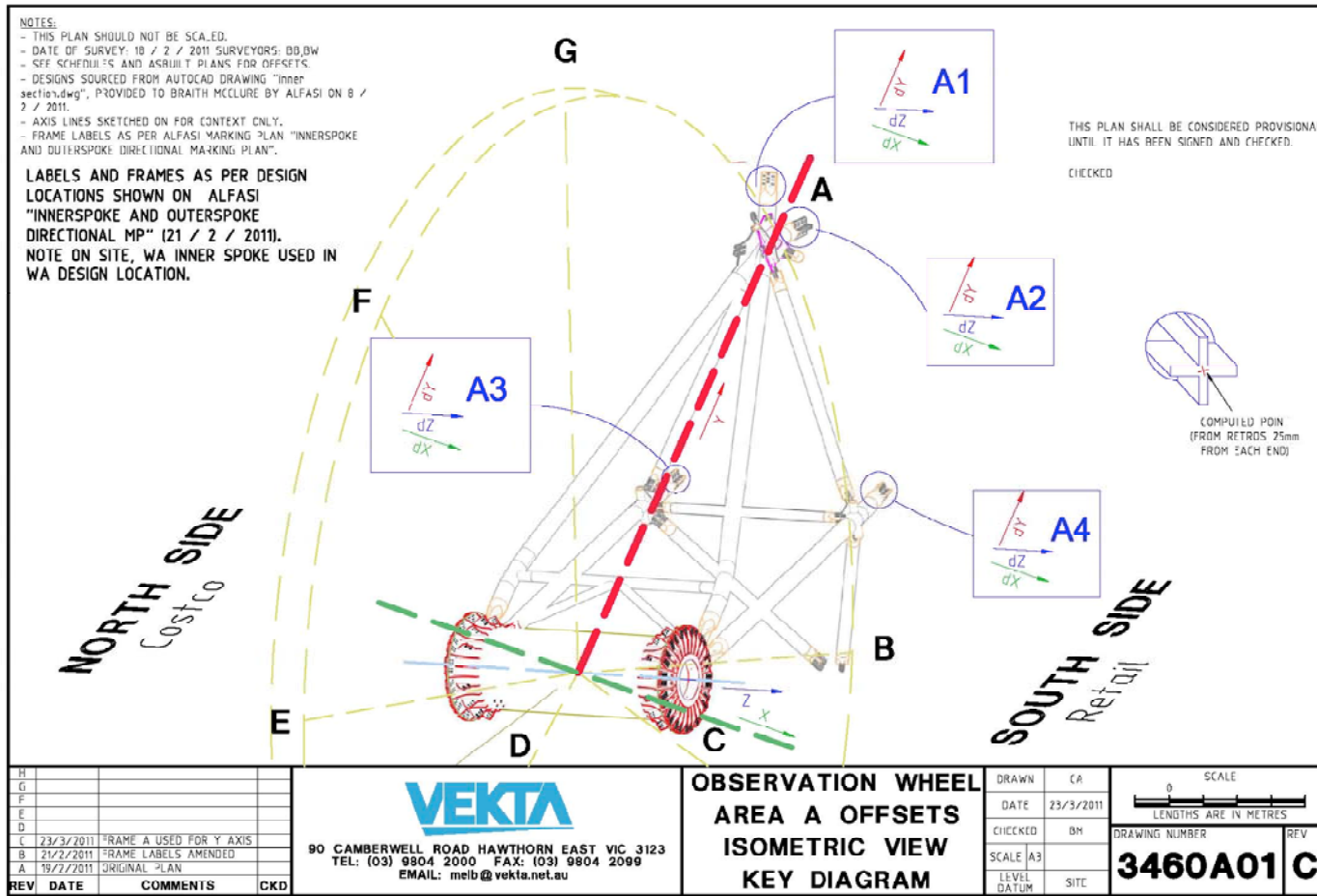
90 CAMBERWELL ROAD HAWTHORN EAST VIC 3123
 TEL: (03) 9804 2000 FAX: (03) 9804 2099
 EMAIL: melb@vekta.net.au

**WFC WHEEL
 SPOKE WF FRAME
 FIXED TO END JIG
 AS-BUILT PLAN**

DRAWN	CA	SCALE 0 LENGTHS ARE IN METRES
DATE	16/5/2011	
CHECKED	BM	DRAWING NUMBER 3460022
SCALE	A3 NTS	
LEVEL DATUM	ARBITRARY	REV A

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Datum Definition



The

SPOKES ON HUB

- Retros placed 25mm in from end of chords on cruciform
 - North and south sides of flanges
- Retros surveyed, midpoint of cruciform computed
- Survey north and south end of hub to check datum
- Alignment (Northing) check at installation

DATA MANIPULATION

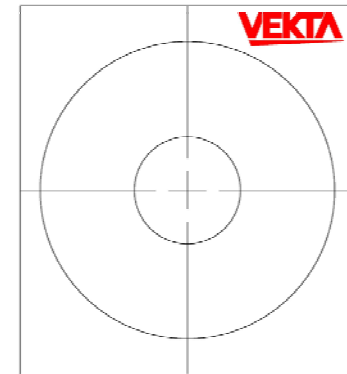
- 3D data set
- Checking of hub, N/S retros
- Transformation of data to rotate A 'up'
- Overlay to design and compute offsets

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EXISTING HUB

- Short baseline and original alignment no longer valid
- Rotating and non-fixed datum - E, N and RL comparisons nonsensical
- North side of hub exposed to more sun, wind issues
- Measurement deflection during measurement – Retro Targets.



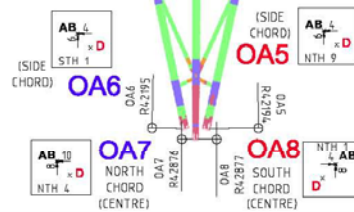
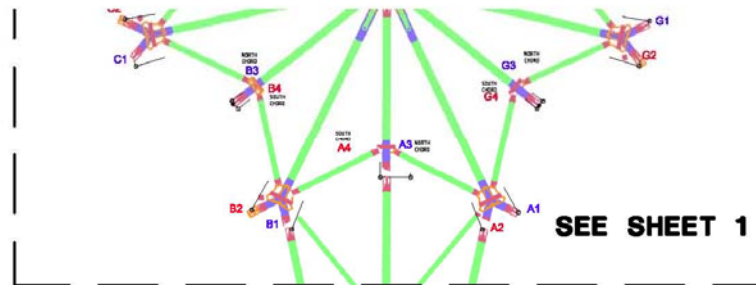
DRAFTING

- Obstructions resulting in incomplete data sets.
- Verification of observed differences – measurement location always unique

OTHER

- Steel deflection at 3 o'clock position.
- Managing expectations and accuracy requirements

As-built outer spoke at 6 o'clock

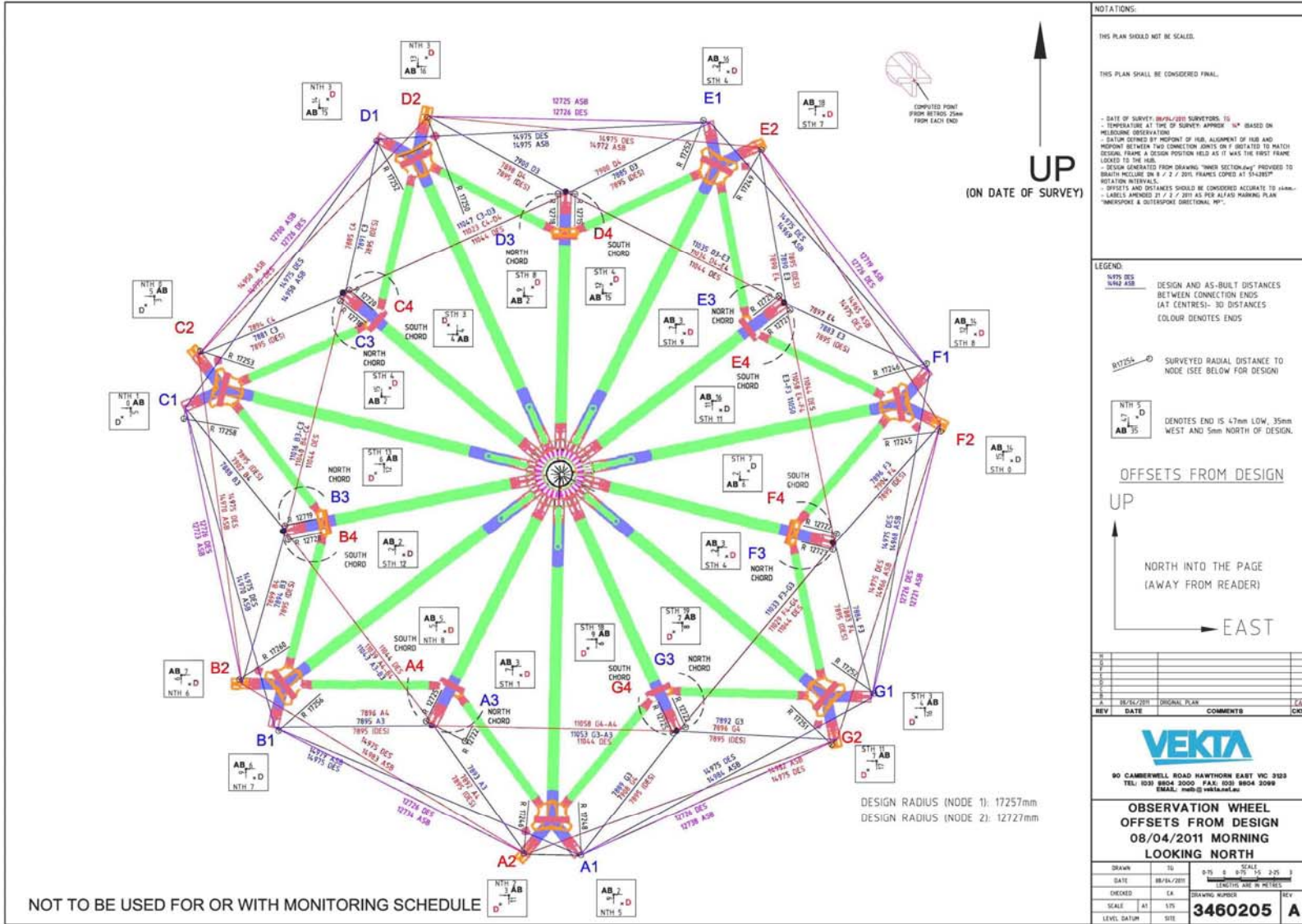


DESIGN RADIUS (CENTRAL NODES): 42200mm
 DESIGN RADIUS (SIDE NODES): 42884mm

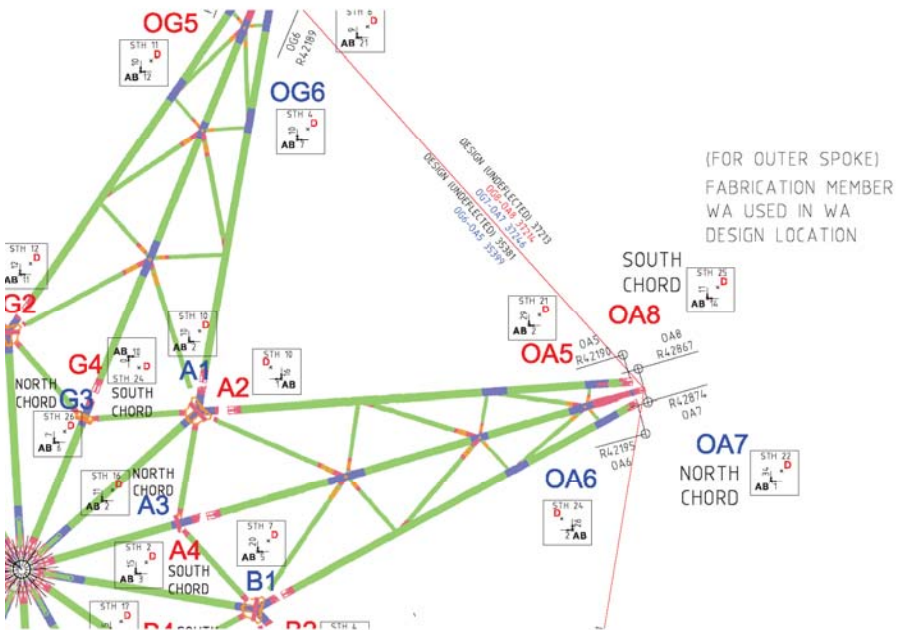
PLAN 3460206: INNER SPOKE E AT VERTICAL,
 AFTER OUTER SPOKE A WAS ADDED

NOTE: INNER SPOKE OFFSETS AND DESIGN
 DISTANCES DO NOT CONSIDER DEFLECTION

BE USED FOR OR WITH
 RING SCHEDULE



As-built outer spoke



PELUBAUNG UDSEKVA (HUB)
 - DATUM DEFINED BY MIDPOINT OF HUB, ALIGNMENT OF HUB + MIDPOINT BETWEEN TWO CONNECTION JOINTS ON FRAME & 1RD MATCH DESIGN. FRAME A DESIGN POSITION HELD AS IT WAS FRAME LOCKED TO THE HUB.
 - DESIGN GENERATED FROM DRAWING "SSOW CAD Model.dwg" TO BRATH MCLLORE ON 8 / 2 / 2011. FRAMES COPIED AT 51 ROTATION INTERVALS.
 - OFFSETS AND DISTANCES SHOULD BE CONSIDERED ACCURAT
 - LABELS AMENDED 21 / 2 / 2011 AS PER ALFASI MARKING "INNERSPOKE & OUTERSPOKE DIRECTIONAL MP".
 - DATUM USED NOT VERTICAL- SEE VEKTA REFERENCE "SSOW Sketch 15th Apr".

LEGEND:

ROBS11254 SURVEYED RADIAL DISTANCE NODE (SEE BELOW FOR DES)

NTH 5 AB 35 DENOTES END IS 47mm LQV WEST AND 5mm NORTH OF

OFFSETS FROM DES

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Monitoring

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Revision D Schedule

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WFC WHEEL
ASBUILT SCHEDULE



FORMERLY QASCO & SURVEY21

Design "Frame A" used for coordinates (Y-axis)
Surveyed "Frame A" best fit for datum

Revision D

Job 3460
Results to 19/07/2011

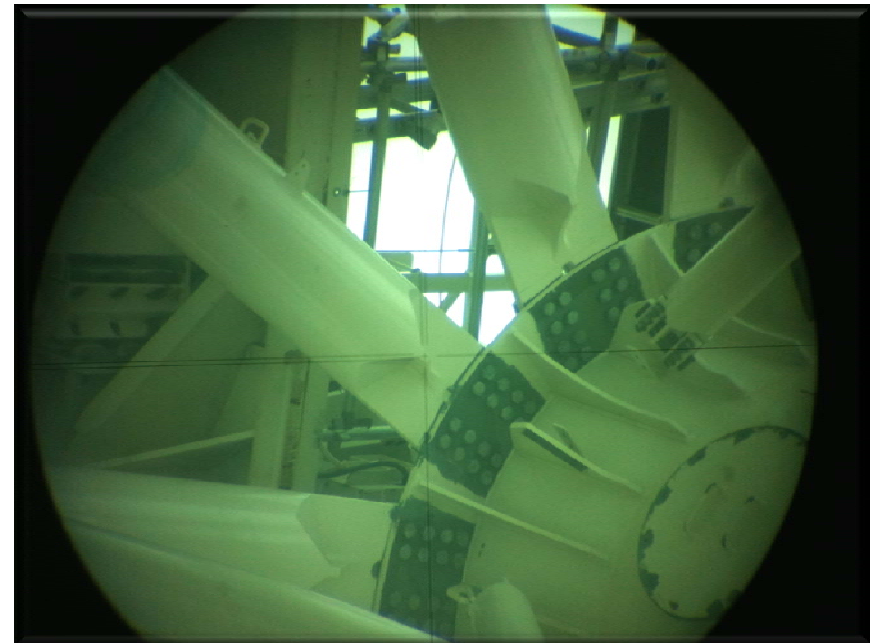
Vertical		B	A	G	F	E
DATE		7/6/11	17/6/11	27/6/11	5/7/11	19/7/11
Time		1030	1300	1130	1300	1300
Point	Temp	10°	13°	15°	12°	15°
HUB S	RL (m)	64.956	64.956 (int)	64.956 (int)	64.955	64.955
HUB N	RL (m)	64.950	64.950 (int)	64.950 (int)	64.953	64.953
A1	dX	-1	7	6	10	12
	dY	-16	-11	-8	-5	-1
	dZ	6	8	10	8	3
A2	dX	1	11	12	14	13
	dY	-17	-13	-10	-8	-8
	dZ	4	7	10	5	-1
A3	dX	8	16	6	12	6
	dY	-11	-10	-9	-5	2
	dZ	11	11	16	9	-3
A4	dX	4	20	9	18	11
	dY	-14	-21	-12	-9	-4
	dZ	-2	1	2	-4	-12
B1	dX	6	17	12	14	12
	dY	-17	-24	-17	-12	-13
	dZ	5	5	7	1	-5
B2	dX	13	19	12	18	14
	dY	-14	-18	-13	-9	-9
	dZ	6	4	4	-3	-8
B3	dX	-1	5	NO SURVEY	9	-3
	dY	-23	-27	NO SURVEY	-7	-18
	dZ	27	23	NO SURVEY	9	15
B4	dX	NO SURVEY	10	-4	10	4
	dY	NO SURVEY	-17	-11	-1	-7
	dZ	NO SURVEY	16	17	7	11
C1	dX	-4	4	0	4	-3
	dY	-24	-21	-13	-5	-9
	dZ	8	4	2	-2	-3
C2	dX	-2	1	-2	4	-3
	dY	-21	-20	-14	-3	-4
	dZ	8	3	3	-6	-2
C3	dX	-1	3	-1	7	-2
	dY	-6	-4	1	5	3
	dZ	23	12	8	6	6
C4	dX	-11	1	-7	5	-5

MONITORING SCHEDULE & KEY PLAN

- Rotated to make Spoke A consistently vertical to enable comparison, unlike as-built plans
- Schedule template - distances and offsets

PLANS

- Shown as-surveyed for practical use
- Vertical at time of survey is vertical on the plan
- Offset enlargement blocks- automated by LiSPs
- Distances between chords and radii also shown



Questions and comments

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- > Nearly done...



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