Table 1 Load Flow Shift Factors Required For Each Methodology (Part "a")

		Uncorrected R-matrix	Corrected R-matrix	Uncorrected R-matrix	Corrected R-matrix	Uncorrected R-matrix	Corrected R-matrix	Uncorrected R-matrix	Corrected R-matrix	Uncorrected R-matrix	Corrected R-matrix
Loading Condition	Average Loss Factor	Swing Bus Methodology	Swing Bus Methodology	Area Load Methodology	Area Load Methodology	50% Area Load Methodology	50% Area Load Methodology	Direct Methodology	Direct Methodology	Gradient Methodology	Gradient Methodology
WnPk	4.77%	2.07%	1.43%	-4.79%	-4.57%	-0.01%	0.10%	2.07%	7.87%	-2.84%	-0.70%
WnMd	5.16%	3.75%	2.88%	-5.25%	-4.99%	-0.04%	0.09%	1.73%	7.47%	-3.62%	-1.84%
WnLw	6.42%	4.19%	3.99%	-7.82%	-6.37%	-0.70%	0.02%	0.86%	6.58%	-6.77%	-5.72%
SpPk	5.01%	2.06%	1.48%	-4.93%	-4.84%	0.04%	0.09%	1.91%	7.87%	-3.19%	-1.67%
SpMd	5.05%	3.30%	2.43%	-5.09%	-4.90%	-0.02%	0.07%	1.63%	8.21%	-3.66%	-2.16%
SpLw	6.41%	3.38%	3.37%	-7.66%	-6.47%	-0.62%	-0.03%	0.93%	6.85%	-6.87%	-7.16%
SmPk	4.32%	1.69%	1.20%	-4.80%	-4.15%	-0.24%	0.08%	1.79%	6.67%	-2.95%	-0.43%
SmMd	4.55%	3.44%	2.67%	-5.12%	-4.42%	-0.29%	0.06%	1.34%	6.43%	-3.66%	-1.85%
SmLw	6.03%	3.04%	3.43%	-8.02%	-6.05%	-0.99%	-0.01%	0.57%	5.93%	-7.14%	-6.41%
FlPk	4.22%	1.03%	0.58%	-4.50%	-4.06%	-0.14%	0.08%	0.57%	6.26%	-2.61%	-0.51%
FlMd	4.65%	3.70%	2.93%	-5.36%	-4.53%	-0.35%	0.06%	1.30%	5.64%	-3.81%	-2.09%
FlLw	5.86%	3.24%	3.42%	-7.70%	-5.86%	-0.92%	0.00%	0.74%	5.55%	-6.77%	-5.73%
Winter Average		3.34%	2.77%	-5.95%	-5.31%	-0.25%	0.07%	1.55%	7.31%	-4.41%	-2.75%
Spring Average		2.91%	2.43%	-5.90%	-5.40%	-0.20%	0.04%	1.49%	7.64%	-4.57%	-3.66%
Summer Average		2.72%	2.43%	-5.98%	-4.88%	-0.51%	0.04%	1.23%	6.34%	-4.58%	-2.90%
Fall Average		2.66%	2.31%	-5.85%	-4.82%	-0.47%	0.05%	0.87%	5.82%	-4.40%	-2.78%
Annual Average		2.91%	2.48%	-5.92%	-5.10%	-0.36%	0.05%	1.29%	6.78%	-4.49%	-3.02%

		Uncorrected R-matrix	Corrected R-matrix	Kron Matrix	Kron Matrix	Kron Matrix	Corrected R-matrix	Branch Loss Matrix
Loading Condition	Average Loss Factor	Gradient/2 Methodology	Gradient/2 Methodology	Direct Methodology	Swing Bus Methodology	Gradient/2 Methodology	ILF Methodology	Flow Tracking
WnPk	4.77%	0.96%	2.03%	1.19%	-11.95%	0.65%	-2.50%	0.51%
WnMd	5.16%	0.77%	1.66%	1.28%	-7.63%	0.68%	-2.89%	0.50%
WnLw	6.42%	-0.18%	0.35%	1.82%	2.50%	0.40%	-3.68%	0.55%
SpPk	5.01%	0.91%	1.67%	1.26%	-9.02%	0.70%	-2.68%	0.56%
SpMd	5.05%	0.69%	1.45%	1.27%	-5.68%	0.75%	-2.83%	0.50%
SpLw	6.41%	-0.23%	-0.37%	1.98%	9.49%	0.38%	-3.57%	0.54%
SmPk	4.32%	0.68%	1.94%	0.91%	-11.19%	0.49%	-2.13%	0.20%
SmMd	4.55%	0.44%	1.35%	0.90%	-5.28%	0.47%	-2.45%	0.18%
SmLw	6.03%	-0.55%	-0.19%	1.72%	5.81%	0.06%	-3.08%	0.19%
FlPk	4.22%	0.81%	1.86%	0.86%	-12.00%	0.46%	-1.93%	0.20%
FlMd	4.65%	0.42%	1.28%	0.89%	-5.52%	0.39%	-2.51%	0.17%
FlLw	5.86%	-0.45%	0.07%	1.47%	3.33%	0.11%	-3.18%	0.18%
Winter Average		0.52%	1.35%	1.43%	-5.69%	0.58%	-3.02%	0.52%
Spring Average		0.46%	0.92%	1.50%	-1.74%	0.61%	-3.03%	0.53%
Summer Average		0.19%	1.03%	1.18%	-3.55%	0.34%	-2.55%	0.19%
Fall Average		0.26%	1.07%	1.07%	-4.73%	0.32%	-2.54%	0.18%
Annual Average		0.36%	1.09%	1.29%	-3.93%	0.46%	-2.79%	0.36%

Legend
Largest Shift Factor per Methodology
Smallest Shift Factor per Methodology

Table 2 Load Flow Shift Factors Required For Each Methodology (Part "b")

Loading Condition	Average Loss Factor	Uncorrected R-matrix Swing Bus Methodology	Corrected R-matrix Swing Bus Methodology	Uncorrected R-matrix Area Load Methodology	Corrected R-matrix Area Load Methodology	Uncorrected R-matrix 50% Area Load Methodology	Corrected R-matrix 50% Area Load Methodology	Uncorrected R-matrix Direct Methodology	Corrected R-matrix Direct Methodology	Uncorrected R-matrix Gradient Methodology	Corrected R-matrix Gradient Methodology
WnPk	4.77%	2.07%	1.43%	-4.79%	-4.57%	-0.01%	0.10%	2.07%	7.87%	-2.84%	-0.70%
WnMd	5.16%	3.75%	2.88%	-5.25%	-4.99%	-0.04%	0.09%	1.73%	7.47%	-3.62%	-1.84%
WnLw	6.42%	4.19%	3.99%	-7.82%	-6.37%	-0.70%	0.02%	0.86%	6.58%	-6.77%	-5.72%
SpPk	5.01%	2.06%	1.48%	-4.93%	-4.84%	0.04%	0.09%	1.91%	7.87%	-3.19%	-1.67%
SpMd	5.05%	3.30%	2.43%	-5.09%	-4.90%	-0.02%	0.07%	1.63%	8.21%	-3.66%	-2.16%
SpLw	6.41%	3.38%	3.37%	-7.66%	-6.47%	-0.62%	-0.03%	0.93%	6.85%	-6.87%	-7.16%
SmPk	4.32%	1.69%	1.20%	-4.80%	-4.15%	-0.24%	0.08%	1.79%	6.67%	-2.95%	-0.43%
SmMd	4.55%	3.44%	2.67%	-5.12%	-4.42%	-0.29%	0.06%	1.34%	6.43%	-3.66%	-1.85%
SmLw	6.03%	3.04%	3.43%	-8.02%	-6.05%	-0.99%	-0.01%	0.57%	5.93%	-7.14%	-6.41%
FlPk	4.22%	1.03%	0.58%	-4.50%	-4.06%	-0.14%	0.08%	0.57%	6.26%	-2.61%	-0.51%
FlMd	4.65%	3.70%	2.93%	-5.36%	-4.53%	-0.35%	0.06%	1.30%	5.64%	-3.81%	-2.09%
FlLw	5.86%	3.24%	3.42%	-7.70%	-5.86%	-0.92%	0.00%	0.74%	5.55%	-6.77%	-5.73%
Winter Average		3.34%	2.77%	-5.95%	-5.31%	-0.25%	0.07%	1.55%	7.31%	-4.41%	-2.75%
Spring Average		2.91%	2.43%	-5.90%	-5.40%	-0.20%	0.04%	1.49%	7.64%	-4.57%	-3.66%
Summer Average		2.72%	2.43%	-5.98%	-4.88%	-0.51%	0.04%	1.23%	6.34%	-4.58%	-2.90%
Fall Average		2.66%	2.31%	-5.85%	-4.82%	-0.47%	0.05%	0.87%	5.82%	-4.40%	-2.78%
Annual Average		2.91%	2.48%	-5.92%	-5.10%	-0.36%	0.05%	1.29%	6.78%	-4.49%	-3.02%

Loading Condition	Average Loss Factor	Uncorrected R-matrix Gradient/2 Methodology	Corrected R-matrix Gradient/2 Methodology	Kron Matrix Direct Methodology	Kron Matrix Swing Bus Methodology	Kron Matrix Gradient/2 Methodology	Corrected R-matrix ILF Methodology	Branch Loss Matrix Flow Tracking
WnPk	4.77%	0.96%	2.03%	1.19%	-11.95%	0.65%	-2.50%	0.51%
WnMd	5.16%	0.77%	1.66%	1.28%	-7.63%	0.68%	-2.89%	0.50%
WnLw	6.42%	-0.18%	0.35%	1.82%	2.50%	0.40%	-3.68%	0.55%
SpPk	5.01%	0.91%	1.67%	1.26%	-9.02%	0.70%	-2.68%	0.56%
SpMd	5.05%	0.69%	1.45%	1.27%	-5.68%	0.75%	-2.83%	0.50%
SpLw	6.41%	-0.23%	-0.37%	1.98%	9.49%	0.38%	-3.57%	0.54%
SmPk	4.32%	0.68%	1.94%	0.91%	-11.19%	0.49%	-2.13%	0.20%
SmMd	4.55%	0.44%	1.35%	0.90%	-5.28%	0.47%	-2.45%	0.18%
SmLw	6.03%	-0.55%	-0.19%	1.72%	5.81%	0.06%	-3.08%	0.19%
FlPk	4.22%	0.81%	1.86%	0.86%	-12.00%	0.46%	-1.93%	0.20%
FlMd	4.65%	0.42%	1.28%	0.89%	-5.52%	0.39%	-2.51%	0.17%
FlLw	5.86%	-0.45%	0.07%	1.47%	3.33%	0.11%	-3.18%	0.18%
Winter Average		0.52%	1.35%	1.43%	-5.69%	0.58%	-3.02%	0.52%
Spring Average		0.46%	0.92%	1.50%	-1.74%	0.61%	-3.03%	0.53%
Summer Average		0.19%	1.03%	1.18%	-3.55%	0.34%	-2.55%	0.19%
Fall Average		0.26%	1.07%	1.07%	-4.73%	0.32%	-2.54%	0.18%
Annual Average		0.36%	1.09%	1.29%	-3.93%	0.46%	-2.79%	0.36%

Legend
Largest Shift Factor Per Load Flow or Season
Smallest Shift Factor Per Load Flow or Season

Table 3 Range of Loss Factors per Methodology

	Uncorrected R-matrix Swing Bus Methodology	Corrected R-matrix Swing Bus Methodology	Uncorrected R-matrix Area Load Methodology	Corrected R-matrix Area Load Methodology	Uncorrected R-matrix 50% Area Load Methodology	Corrected R-matrix 50% Area Load Methodology
Maximum Loss Factor	28.72%	18.88%	26.57%	17.82%	15.89%	11.51%
Minimum Loss Factor	-33.14%	-21.29%	-29.76%	-19.21%	-12.28%	-7.00%
Range of Loss Factors	61.86%	40.17%	56.33%	37.03%	28.17%	18.52%
No. Greater Than Maximum Permitted	20	20	20	20	19	3
No. Less Than Minimum Permitted	66	60	63	58	38	9
No of Generators Exceeding Criteria	86	80	83	78	57	12
Seasonal Volatility	11.45%	11.37%	10.22%	10.31%	4.87%	4.92%

	Uncorrected R-matrix Direct Methodology	Corrected R-matrix Direct Methodology	Uncorrected R-matrix Gradient Methodology	Corrected R-matrix Gradient Methodology	Uncorrected R-matrix Gradient/2 Methodology	Corrected R-matrix Gradient/2 Methodology
Maximum Loss Factor	16.15%	7.95%	26.91%	18.12%	16.06%	11.66%
Minimum Loss Factor	-18.13%	-24.16%	-30.34%	-19.77%	-12.57%	-7.28%
Range of Loss Factors	34.28%	32.12%	57.25%	37.89%	28.62%	18.95%
No. Greater Than Maximum Permitted	17	0	20	20	20	3
No. Less Than Minimum Permitted	41	19	64	60	40	9
No of Generators Exceeding Criteria	58	19	84	80	60	12
Seasonal Volatility	8.07%	6.78%	10.43%	10.69%	4.98%	5.10%

	Kron Matrix Direct Methodology	Kron Matrix Swing Bus Methodology	Kron Matrix Gradient/2 Methodology	Corrected R-matrix ILF Methodology	Branch Loss Matrix Flow Tracking
Maximum Loss Factor	10.33%	17.29%	11.23%	16.36%	31.93%
Minimum Loss Factor	-5.30%	-18.06%	-6.35%	-20.74%	0.36%
Range of Loss Factors	15.62%	35.35%	17.57%	37.11%	31.57%
No. Greater Than Maximum Permitted	0	20	3	20	4
No. Less Than Minimum Permitted	1	57	2	58	0
No of Generators Exceeding Criteria	1	77	5	78	4
Seasonal Volatility	4.01%	9.02%	4.46%	7.28%	78.73%

Legend
Largest Magnitude per Methodology
Smallest Magnitude per Methodology

Table 4 Ranking of Methodologies Based on Magnitude of Shift Factor

		Uncorrected R-matrix	Corrected R-matrix	Uncorrected R-matrix	Corrected R-matrix	Uncorrected R-matrix	Corrected R-matrix	Uncorrected R-matrix	Corrected R-matrix	Uncorrected R-matrix	Corrected R-matrix
Loading Condition	Average Loss Factor	Swing Bus Methodology	Swing Bus Methodology	Area Load Methodology	Area Load Methodology	50% Area Load Methodology	50% Area Load Methodology	Direct Methodology	Direct Methodology	Gradient Methodology	Gradient Methodology
WnPk	4.77%	11	8	15	14	1	2	10	16	13	5
WnMd	5.16%	13	10	15	14	1	2	8	16	12	9
WnLw	6.42%	12	11	17	14	6	1	7	15	16	13
SpPk	5.01%	11	7	15	14	1	2	10	16	13	8
SpMd	5.05%	12	10	15	14	1	2	8	17	13	9
SpLw	6.41%	10	9	16	12	6	1	7	13	14	15
SmPk	4.32%	9	8	15	14	3	1	10	16	13	4
SmMd	4.55%	12	11	15	14	3	1	7	17	13	9
SmLw	6.03%	9	11	17	14	7	1	6	13	16	15
FlPk	4.22%	10	7	15	14	2	1	6	16	13	5
FlMd	4.65%	12	11	15	14	3	1	8	17	13	9
FlLw	5.86%	10	12	17	15	7	1	6	13	16	14
Winter Average		12	10	16	14	2	1	8	17	13	9
Spring Average		11	10	16	15	2	1	7	17	14	13
Summer Average		11	9	16	15	5	1	8	17	14	12
Fall Average		11	9	17	15	5	1	6	16	13	12
Annual Average		11	9	16	15	4	1	7	17	14	12
Weighted Average		11.06	9.36	15.94	14.56	3.64	1.11	7.33	16.39	13.75	11.03
Overall Ranking		12	9	16	15	4	1	7	17	14	11

		Uncorrected R-matrix	Corrected R-matrix	Kron Matrix	Kron Matrix	Kron Matrix	Corrected R-matrix	Branch Loss Matrix
Loading Condition	Average Loss Factor	Gradient/2 Methodology	Gradient/2 Methodology	Direct Methodology	Swing Bus Methodology	Gradient/2 Methodology	ILF Methodology	Flow Tracking
WnPk	4.77%	6	9	7	17	4	12	3
WnMd	5.16%	5	7	6	17	4	11	3
WnLw	6.42%	2	3	8	9	4	10	5
SpPk	5.01%	5	9	6	17	4	12	3
SpMd	5.05%	4	7	6	16	5	11	3
SpLw	6.41%	2	3	8	17	4	11	5
SmPk	4.32%	6	11	7	17	5	12	2
SmMd	4.55%	4	8	6	16	5	10	2
SmLw	6.03%	5	4	8	12	2	10	3
FlPk	4.22%	8	11	9	17	4	12	3
FlMd	4.65%	5	7	6	16	4	10	2
FlLw	5.86%	5	2	8	11	3	9	4
Winter Average		3	6	7	15	5	11	4
Spring Average		3	6	8	9	5	12	4
Summer Average		3	6	7	13	4	10	2
Fall Average		3	7	8	14	4	10	2
Annual Average		2	6	8	13	5	10	3
Weighted Average		3.25	6.33	7.53	13.64	4.50	10.53	3.06
Overall Ranking		3	6	8	13	5	10	1

Legend

Largest Ranking Per Load Flow or Season

Smallest Ranking Per Load Flow or Season

Table 5 Overall Ranking Of Methodologies

Criteria	Weighting	Uncorrected R-matrix Swing Bus Methodology	Corrected R-matrix Swing Bus Methodology	Uncorrected R-matrix Area Load Methodology	Corrected R-matrix Area Load Methodology	Uncorrected R-matrix 50% Area Load Methodology	Corrected R-matrix 50% Area Load Methodology
Shift Factor	1	12	9	16	15	4	1
Number of Generators That Exceed the Limits	1	17	13	15	11	7	4
Range of Loss Factors	1	17	14	15	11	5	3
Seasonal Volatility	1	16	15	11	12	3	4
Swing Independent	1	15	15	1	1	1	1
Weighted Sum		15.40	13.20	11.60	10.00	4.00	2.60
Final Ranking		17	16	13	11	2	1

Criteria	Weighting	Uncorrected R-matrix Direct Methodology	Corrected R-matrix Direct Methodology	Uncorrected R-matrix Gradient Methodology	Corrected R-matrix Gradient Methodology	Uncorrected R-matrix Gradient/2 Methodology	Corrected R-matrix Gradient/2 Methodology
Shift Factor	1	7	17	14	11	3	6
Number of Generators That Exceed the Limits	1	8	6	16	13	9	4
Range of Loss Factors	1	9	8	16	13	6	4
Seasonal Volatility	1	9	7	13	14	5	6
Swing Independent	1	1	1	1	1	1	1
Weighted Sum		6.80	7.80	12.00	10.40	4.80	4.20
Final Ranking		8	9	15	12	4	3

Criteria	Weighting	Kron Matrix Direct Methodology	Kron Matrix Swing Bus Methodology	Kron Matrix Gradient/2 Methodology	Corrected R-matrix ILF Methodology	Branch Loss Matrix Flow Tracking
Shift Factor	1	8	13	5	10	1
Number of Generators That Exceed the Limits	1	1	10	3	11	2
Range of Loss Factors	1	1	10	2	12	7
Seasonal Volatility	1	1	10	2	8	17
Swing Independent	1	15	15	15	1	1
Weighted Sum		5.20	11.60	5.40	8.40	5.60
Final Ranking		5	13	6	10	7

Legend		
	1	Ranking =1
	2	Ranking = 2 or 3
	15	Ranking >= 4

Table 6 Overall Ranking Of Corrected Matrix Methodologies

Criteria	Weighting	Corrected R-matrix Swing Bus Methodology	Corrected R-matrix Area Load Methodology	Corrected R-matrix 50% Area Load Methodology	Corrected R-matrix Direct Methodology	Corrected R-matrix Gradient Methodology	Corrected R-matrix Gradient/2 Methodology
Shift Factor	1	6	10	1	11	8	4
Number of Generators That Exceed the Limits	1	10	8	4	6	10	4
Range of Loss Factors	1	11	8	3	6	10	4
Seasonal Volatility	1	10	8	3	5	9	4
Swing Independent	1	9	1	1	1	1	1
Weighted Sum		9.20	7.00	2.40	5.80	7.60	3.40
Final Ranking		11	8	1	6	9	2

Criteria	Weighting	Kron Matrix Direct Methodology	Kron Matrix Swing Bus Methodology	Kron Matrix Gradient/2 Methodology	Corrected R-matrix ILF Methodology	Branch Loss Matrix Flow Tracking
Shift Factor	1	5	9	3	7	1
Number of Generators That Exceed the Limits	1	1	7	3	8	2
Range of Loss Factors	1	1	7	2	9	5
Seasonal Volatility	1	1	7	2	6	11
Swing Independent	1	9	9	9	1	1
Weighted Sum		3.40	7.80	3.80	6.20	4.00
Final Ranking		2	10	4	7	5

Legend		
	1	Ranking =1
	2	Ranking = 2 or 3
	15	Ranking >= 4

Table 7 Overall Ranking Of Uncorrected Matrix Methodologies

Criteria	Weighting	Uncorrected R-matrix Swing Bus Methodology	Uncorrected R-matrix Area Load Methodology	Uncorrected R-matrix 50% Area Load Methodology	Uncorrected R-matrix Direct Methodology	Uncorrected R-matrix Gradient Methodology	Uncorrected R-matrix Gradient/2 Methodology
Shift Factor	1	4	6	2	3	5	1
Number of Generators That Exceed the Limits	1	6	4	1	2	5	3
Range of Loss Factors	1	6	4	1	3	5	2
Seasonal Volatility	1	6	4	1	3	5	2
Swing Independent	1	6	1	1	1	1	1
Weighted Sum		5.60	3.80	1.20	2.40	4.20	1.80
Final Ranking		6	4	1	3	5	2

Legend		
	1	Ranking =1
	2	Ranking = 2 or 3
	15	Ranking >= 4