

# Online supplementary document to the paper “Coordinated routing of electric commercial vehicles with intra-route recharging and en-route battery swapping”

*Ramin Raeesi and Konstantinos G. Zografos*

## Detailed results

**Table SD.1**

Detailed CPLEX results of all experiments on instances with 5, 10 and 15 customers under all settings

Problem Type	No.	Instance	V <sub>E</sub>	D <sub>E</sub>	V <sub>B</sub>	D <sub>B</sub>	S	V <sub>T</sub>	D <sub>T</sub>	MIP gap
EVRPTW-RS-SMBS	1	C101-5	3	254.37	1	59.46	1	4	313.84	0.00
	2	C103-5	2	154.50	0	0.00	0	2	154.50	0.00
	3	C206-5	1	214.36	0	0.00	0	1	214.36	0.00
	4	C208-5	1	180.96	0	0.00	0	1	180.96	0.00
	5	R104-5	3	161.25	0	0.00	0	3	161.25	0.00
	6	R105-5	3	182.92	0	0.00	0	3	182.92	0.00
	7	R202-5	1	128.78	0	0.00	0	1	128.78	0.00
	8	R203-5	1	242.41	0	0.00	0	1	242.41	0.00
	9	RC105-5	3	238.05	0	0.00	0	3	238.05	0.00
	10	RC108-5	3	316.51	0	0.00	0	3	316.51	0.00
	11	RC204-5	1	179.16	0	0.00	0	1	179.16	0.00
	12	RC208-5	1	167.98	0	0.00	0	1	167.98	0.00
	13	C101-10	3	392.93	1	134.59	2	4	527.52	0.00
	14	C104-10	1	234.22	1	98.65	3	2	332.87	0.00
	15	C202-10	2	264.76	0	0.00	0	2	264.76	0.00
	16	C205-10	2	228.28	0	0.00	0	2	228.28	0.00
	17	R102-10	3	226.71	1	57.96	2	4	284.67	0.00
	18	R103-10	3	211.24	0	0.00	0	3	211.24	0.00
	19	R201-10	1	292.78	0	0.00	0	1	292.78	0.00
	20	R203-10	2	232.68	0	0.00	0	2	232.68	0.00
	21	RC102-10	5	429.15	0	0.00	0	5	429.15	0.00
	22	RC108-10	4	396.22	0	0.00	0	4	396.22	0.00
	23	RC201-10	2	313.65	0	0.00	0	2	313.65	0.00
	24	RC205-10	2	393.55	0	0.00	0	2	393.55	0.00
	25	C103-15	2	391.69	1	125.09	4	3	516.78	0.35
	26	C106-15	3	285.20	1	107.84	2	4	393.04	0.00
	27	C202-15	3	384.80	0	0.00	0	3	384.80	0.00
	28	C208-15	2	287.42	0	0.00	0	2	287.42	0.00
	29	R102-15	4	362.05	0	0.00	0	4	362.05	0.00
	30	R105-15	4	361.36	1	85.61	3	5	446.96	0.00
	31	R202-15	3	417.95	0	0.00	0	3	417.95	0.00
	32	R209-15	2	338.54	0	0.00	0	2	338.54	0.00
	33	RC103-15	5	469.67	0	0.00	0	5	469.67	0.00
	34	RC108-15	5	467.58	0	0.00	0	5	467.58	0.00
	35	RC202-15	2	381.44	0	0.00	0	2	381.44	0.00
	36	RC204-15	1	353.56	0	0.00	0	1	353.56	0.18
EVRPTW-SMBS	1	C101-5	3	254.37	1	59.46	1	4	313.84	0.00
	2	C103-5	1	152.66	1	20.00	1	2	172.66	0.00
	3	C206-5	1	213.78	1	148.52	3	2	362.31	0.00
	4	C208-5	1	157.72	1	138.74	2	2	296.45	0.00
	5	R104-5	2	159.43	1	79.73	2	3	239.17	0.00
	6	R105-5	2	165.09	1	61.31	2	3	226.40	0.00
	7	R202-5	1	126.52	1	70.98	2	2	197.50	0.00
	8	R203-5	1	202.79	2	186.17	4	3	388.96	0.00

9	RC105-5	3	237.69	1	86.02	1	4	323.72	0.00
10	RC108-5	2	245.87	2	182.43	3	4	428.31	0.00
11	RC204-5	1	172.43	1	96.62	2	2	269.06	0.00
12	RC208-5	1	170.01	1	106.60	2	2	276.61	0.00
13	C101-10	3	336.64	2	178.92	3	5	515.55	0.00
14	C104-10	1	234.22	1	98.65	3	2	332.87	0.00
15	C202-10	2	249.17	1	125.59	3	3	374.76	0.00
16	C205-10	2	226.01	1	144.14	4	3	370.15	0.00
17	R102-10	3	226.28	2	116.40	3	5	342.68	0.00
18	R103-10	2	170.48	1	49.34	2	3	219.81	0.00
19	R201-10	2	234.75	1	67.95	3	3	302.70	0.00
20	R203-10	1	234.49	2	136.31	4	3	370.80	0.00
21	RC102-10	3	439.24	2	244.49	5	5	683.73	0.00
22	RC108-10	2	324.74	2	218.87	5	4	543.61	0.00
23	RC201-10	2	308.48	1	109.06	4	3	417.54	0.00
24	RC205-10	3	395.07	1	118.06	3	4	513.13	0.00
25	C103-15	3	323.34	1	120.76	4	4	444.10	0.00
26	C106-15	3	285.20	1	107.84	2	4	393.04	0.00
27	C202-15	3	372.68	1	141.85	4	4	514.53	0.00
28	C208-15	2	275.89	1	146.22	2	3	422.12	0.00
29	R102-15	3	342.39	1	92.79	4	4	435.18	0.00
30	R105-15	3	344.59	2	199.65	6	5	544.24	0.00
31	R202-15	_*	-	-	-	-	-	-	-
32	R209-15	2	286.47	2	120.05	4	4	406.52	0.00
33	RC103-15	4	427.17	2	233.12	4	6	660.29	0.00
34	RC108-15	3	364.69	2	148.58	4	5	513.27	0.00
35	RC202-15	1	371.24	2	172.97	5	3	544.20	0.00
36	RC204-15	2	304.47	1	137.84	3	3	442.31	0.05
1	C101-5	5	296.09	0	0	0	5	296.09	0.00
2	C103-5	2	154.50	0	0	0	2	154.50	0.00
3	C206-5	1	214.36	0	0	0	1	214.36	0.00
4	C208-5	1	180.96	0	0	0	1	180.96	0.00
5	R104-5	3	161.25	0	0	0	3	161.25	0.00
6	R105-5	3	182.92	0	0	0	3	182.92	0.00
7	R202-5	1	128.78	0	0	0	1	128.78	0.00
8	R203-5	1	242.41	0	0	0	1	242.41	0.00
9	RC105-5	3	238.05	0	0	0	3	238.05	0.00
10	RC108-5	3	316.51	0	0	0	3	316.51	0.00
11	RC204-5	1	179.16	0	0	0	1	179.16	0.00
12	RC208-5	1	167.98	0	0	0	1	167.98	0.00
13	C101-10	5	443.52	0	0	0	5	443.52	0.00
14	C104-10	3	309.86	0	0	0	3	309.86	0.00
15	C202-10	2	264.76	0	0	0	2	264.76	0.00
16	C205-10	2	228.28	0	0	0	2	228.28	0.00
17	R102-10	4	293.16	0	0	0	4	293.16	0.00
18	R103-10	3	211.24	0	0	0	3	211.24	0.00
19	R201-10	1	292.78	0	0	0	1	292.78	0.00
20	R203-10	2	232.68	0	0	0	2	232.68	0.00
21	RC102-10	5	429.15	0	0	0	5	429.15	0.00
22	RC108-10	4	396.22	0	0	0	4	396.22	0.00
23	RC201-10	2	313.65	0	0	0	2	313.65	0.00
24	RC205-10	2	393.55	0	0	0	2	393.55	0.00
25	C103-15	5	403.74	0	0	0	5	403.74	0.00
26	C106-15	5	334.14	0	0	0	5	334.14	0.00
27	C202-15	3	384.80	0	0	0	3	384.80	0.00
28	C208-15	2	287.42	0	0	0	2	287.42	0.00
29	R102-15	4	362.05	0	0	0	4	362.05	0.00
30	R105-15	6	409.66	0	0	0	6	409.66	0.00

31	R202-15	3	417.95	0	0	0	3	417.95	0.00
32	R209-15	2	338.54	0	0	0	2	338.54	0.00
33	RC103-15	5	469.67	0	0	0	5	469.67	0.00
34	RC108-15	5	467.58	0	0	0	5	467.58	0.00
35	RC202-15	2	381.44	0	0	0	2	381.44	0.00
36	RC204-15	1	353.56	0	0	0	1	353.56	0.18

\* No feasible solution found within the permitted CPU time

**Table SD.2**

Detailed CPLEX results of all experiments on instances with 25 customers and 21 RSs under all settings

Problem Type	No.	Instance	V <sub>E</sub>	D <sub>E</sub>	V <sub>B</sub>	D <sub>B</sub>	S	V <sub>T</sub>	D <sub>T</sub>	MIP gap
EVRP-RS-SMBS	1	C101-25	6	615.86	1	126.49	3	7	742.36	0.00
	2	C102-25	5	527.27	1	145.89	4	6	673.16	0.07
	3	C103-25	4	420.90	1	30.52	2	5	451.42	0.47
	4	C104-25	-	-	-	-	-	-	-	-
	5	C105-25	5	584.64	1	116.20	4	6	700.84	0.00
	6	C106-25	5	552.10	1	83.38	3	6	635.47	0.00
	7	C107-25	4	533.02	1	147.65	4	5	680.68	0.00
	8	C108-25	6	526.23	0	0.00	0	6	526.23	0.00
	9	C109-25	4	472.53	1	92.74	3	5	565.27	0.27
	10	C201-25	3	395.89	0	0.00	0	3	395.89	0.00
	11	C202-25	3	408.42	0	0.00	0	3	408.42	0.00
	12	C203-25	3	428.89	0	0.00	0	3	428.89	0.00
	13	C204-25	2	342.49	0	0.00	0	2	342.49	0.00
	14	C205-25	2	430.81	0	0.00	0	2	430.81	0.00
	15	C206-25	-	-	-	-	-	-	-	-
	16	C207-25	2	446.40	0	0.00	0	2	446.40	0.00
	17	C208-25	3	410.71	0	0.00	0	3	410.71	0.00
	18	R101-25	9	733.95	0	0.00	0	9	733.95	0.00
	19	R102-25	8	555.78	1	51.57	2	9	607.35	0.12
	20	R103-25	-	-	-	-	-	-	-	-
	21	R104-25	5	394.77	0	0.00	0	5	394.77	0.29
	22	R105-25	6	602.63	1	98.40	4	7	701.03	0.07
	23	R106-25	7	532.54	0	0.00	0	7	532.54	0.32
	24	R107-25	5	423.01	1	12.65	1	6	435.66	0.23
	25	R108-25	6	502.95	0	0.00	0	6	502.95	0.62
	26	R109-25	7	530.15	0	0.00	0	7	530.15	0.00
	27	R110-25	-	-	-	-	-	-	-	-
	28	R111-25	-	-	-	-	-	-	-	-
	29	R112-25	-	-	-	-	-	-	-	-
	30	R201-25	2	434.49	0	0.00	0	2	434.49	0.00
	31	R202-25	2	477.91	0	0.00	0	2	477.91	0.00
	32	R203-25	2	465.73	0	0.00	0	2	465.73	0.13
	33	R204-25	2	306.89	0	0.00	0	2	306.89	0.02
	34	R205-25	2	411.87	0	0.00	0	2	411.87	0.00
	35	R206-25	2	391.50	0	0.00	0	2	391.50	0.00
	36	R207-25	2	340.55	0	0.00	0	2	340.55	0.00
	37	R208-25	2	306.38	0	0.00	0	2	306.38	0.00
	38	R209-25	2	399.01	0	0.00	0	2	399.01	0.00
	39	R210-25	2	334.43	0	0.00	0	2	334.43	0.00
	40	R211-25	2	368.92	0	0.00	0	2	368.92	0.06
	41	RC101-25	6	728.46	1	150.26	4	7	878.72	0.00
	42	RC102-25	8	747.90	0	0.00	0	8	747.90	0.00
	43	RC103-25	5	528.98	0	0.00	0	5	528.98	0.11
	44	RC104-25	7	674.54	0	0.00	0	7	674.54	0.24
	45	RC105-25	7	665.35	0	0.00	0	7	665.35	0.00
	46	RC106-25	7	637.48	0	0.00	0	7	637.48	0.00
	47	RC107-25	-	-	-	-	-	-	-	-

48	RC108-25	-	-	-	-	-	-	-	-
49	RC201-25	2	733.54	0	0.00	0	2	733.54	0.00
50	RC202-25	2	568.59	0	0.00	0	2	568.59	0.03
51	RC203-25	2	499.17	0	0.00	0	2	499.17	0.15
52	RC204-25	2	400.77	0	0.00	0	2	400.77	0.09
53	RC205-25	2	611.26	0	0.00	0	2	611.26	0.00
54	RC206-25	3	538.02	0	0.00	0	3	538.02	0.00
55	RC207-25	3	473.78	0	0.00	0	3	473.78	0.00
56	RC208-25	2	439.62	0	0.00	0	2	439.62	0.03
1	C101-25	5	621.10	2	184.32	5	7	805.42	0.00
2	C102-25	-	-	-	-	-	-	-	-
3	C103-25	5	384.97	1	30.27	1	6	415.23	0.08
4	C104-25	3	431.03	1	132.42	4	4	563.44	0.44
5	C105-25	5	640.79	1	151.02	4	6	791.81	0.00
6	C106-25	5	537.25	2	194.98	7	7	732.22	0.00
7	C107-25	4	528.61	2	111.83	7	6	640.44	0.00
8	C108-25	4	461.76	2	163.37	5	6	625.13	0.00
9	C109-25	3	453.91	2	141.98	4	5	595.89	0.12
10	C201-25	3	395.02	1	82.78	2	4	477.80	0.00
11	C202-25	3	423.57	1	53.81	1	4	477.39	0.00
12	C203-25	2	452.55	1	85.64	3	3	538.19	0.31
13	C204-25	2	342.18	1	50.34	2	3	392.52	0.13
14	C205-25	2	407.90	1	103.67	2	3	511.57	0.00
15	C206-25	3	388.85	1	81.19	2	4	470.04	0.00
16	C207-25	2	425.51	1	122.51	3	3	548.02	0.00
17	C208-25	2	453.61	1	76.37	3	3	529.97	0.00
18	R101-25	8	641.39	2	229.84	8	10	871.23	0.00
19	R102-25	8	552.46	2	151.00	7	10	703.45	0.08
20	R103-25	5	432.62	2	105.21	6	7	537.83	0.30
21	R104-25	4	392.05	2	86.78	4	6	478.82	0.41
22	R105-25	5	540.49	2	235.44	7	7	775.93	0.00
23	R106-25	5	472.53	2	153.98	5	7	626.51	0.13
24	R107-25	4	402.51	2	174.04	5	6	576.55	0.22
25	R108-25	5	450.84	2	151.34	5	7	602.18	0.70
26	R109-25	6	500.07	1	107.12	4	7	607.19	0.18
27	R110-25	5	423.27	2	110.53	5	7	533.81	0.37
28	R111-25	4	413.46	2	145.48	5	6	558.94	0.34
29	R112-25	-	-	-	-	-	-	-	-
30	R201-25	3	402.19	0	0.00	0	3	402.19	0.00
31	R202-25	3	429.94	0	0.00	0	3	429.94	0.00
32	R203-25	3	439.77	0	0.00	0	3	439.77	0.00
33	R204-25	2	309.38	0	0.00	0	2	309.38	0.00
34	R205-25	3	403.97	0	0.00	0	3	403.97	0.00
35	R206-25	3	392.67	0	0.00	0	3	392.67	0.00
36	R207-25	2	340.55	0	0.00	0	2	340.55	0.00
37	R208-25	2	306.38	0	0.00	0	2	306.38	0.00
38	R209-25	3	385.72	0	0.00	0	3	385.72	0.00
39	R210-25	3	330.86	0	0.00	0	3	330.86	0.00
40	R211-25	2	368.92	0	0.00	0	2	368.92	0.00
41	RC101-25	6	691.24	2	275.12	7	8	966.35	0.00
42	RC102-25	6	736.99	2	210.54	7	8	947.53	0.00
43	RC103-25	4	485.92	2	181.09	6	6	667.01	0.47
44	RC104-25	5	586.01	2	199.66	6	7	785.67	0.42
45	RC105-25	6	604.86	2	218.46	6	8	823.32	0.09
46	RC106-25	5	584.28	2	183.96	6	7	768.24	0.15
47	RC107-25	5	536.39	2	141.57	6	7	677.96	0.39
48	RC108-25	4	481.15	2	167.68	5	6	648.84	0.69
49	RC201-25	2	732.99	1	79.31	3	3	812.29	0.00

50	RC202-25	3	528.75	0	0.00	0	3	528.75	0.00
51	RC203-25	3	462.73	0	0.00	0	3	462.73	0.00
52	RC204-25	3	441.83	0	0.00	0	3	441.83	0.06
53	RC205-25	2	610.03	1	52.68	2	3	662.71	0.00
54	RC206-25	3	570.24	0	0.00	0	3	570.24	0.00
55	RC207-25	3	473.78	0	0.00	0	3	473.78	0.00
56	RC208-25	3	451.79	0	0.00	0	3	451.79	0.00
1	C101-25	9	855.82	0	0	0	9	855.82	0.00
2	C102-25	8	696.15	0	0	0	8	696.15	0.00
3	C103-25	6	414.05	0	0	0	6	414.05	0.07
4	C104-25	5	504.34	0	0	0	5	504.34	0.32
5	C105-25	8	660.82	0	0	0	8	660.82	0.00
6	C106-25	8	749.21	0	0	0	8	749.21	0.00
7	C107-25	6	537.16	0	0	0	6	537.16	0.00
8	C108-25	6	526.23	0	0	0	6	526.23	0.00
9	C109-25	6	604.36	0	0	0	6	604.36	0.00
10	C201-25	3	395.89	0	0	0	3	395.89	0.00
11	C202-25	3	408.42	0	0	0	3	408.42	0.00
12	C203-25	3	428.89	0	0	0	3	428.89	0.00
13	C204-25	2	342.49	0	0	0	2	342.49	0.06
14	C205-25	2	430.81	0	0	0	2	430.81	0.00
15	C206-25	2	477.33	0	0	0	2	477.33	0.00
16	C207-25	2	446.40	0	0	0	2	446.40	0.00
17	C208-25	3	410.71	0	0	0	3	410.71	0.00
18	R101-25	9	733.95	0	0	0	9	733.95	0.00
19	R102-25	9	612.00	0	0	0	9	612.00	0.00
20	R103-25	6	450.49	0	0	0	6	450.49	0.10
21	R104-25	5	395.43	0	0	0	5	395.43	0.29
22	R105-25	8	640.88	0	0	0	8	640.88	0.00
23	R106-25	7	532.54	0	0	0	7	532.54	0.00
24	R107-25	6	471.69	0	0	0	6	471.69	0.13
25	R108-25	6	502.95	0	0	0	6	502.95	0.37
26	R109-25	7	530.15	0	0	0	7	530.15	0.00
27	R110-25	6	450.88	0	0	0	6	450.88	0.14
28	R111-25	6	499.58	0	0	0	6	499.58	0.09
29	R112-25	5	423.43	0	0	0	5	423.43	0.35
30	R201-25	2	434.49	0	0	0	2	434.49	0.00
31	R202-25	2	477.91	0	0	0	2	477.91	0.00
32	R203-25	2	465.73	0	0	0	2	465.73	0.16
33	R204-25	2	306.90	0	0	0	2	306.90	0.04
34	R205-25	2	411.87	0	0	0	2	411.87	0.00
35	R206-25	2	391.50	0	0	0	2	391.50	0.00
36	R207-25	2	340.55	0	0	0	2	340.55	0.00
37	R208-25	2	306.38	0	0	0	2	306.38	0.00
38	R209-25	2	399.01	0	0	0	2	399.01	0.00
39	R210-25	2	334.43	0	0	0	2	334.43	0.00
40	R211-25	2	368.92	0	0	0	2	368.92	0.03
41	RC101-25	9	845.51	0	0	0	9	845.51	0.00
42	RC102-25	8	747.90	0	0	0	8	747.90	0.00
43	RC103-25	5	528.98	0	0	0	5	528.98	0.11
44	RC104-25	7	674.54	0	0	0	7	674.54	0.24
45	RC105-25	7	665.35	0	0	0	7	665.35	0.00
46	RC106-25	7	637.48	0	0	0	7	637.48	0.00
47	RC107-25	7	690.68	0	0	0	7	690.68	0.37
48	RC108-25	6	558.41	0	0	0	6	558.41	0.35
49	RC201-25	2	733.54	0	0	0	2	733.54	0.00
50	RC202-25	2	568.59	0	0	0	2	568.59	0.01
51	RC203-25	2	500.36	0	0	0	2	500.36	0.16

52	RC204-25	2	400.77	0	0	0	2	400.77	0.02
53	RC205-25	2	611.26	0	0	0	2	611.26	0.00
54	RC206-25	3	538.02	0	0	0	3	538.02	0.00
55	RC207-25	3	473.78	0	0	0	3	473.78	0.00
56	RC208-25	2	439.62	0	0	0	2	439.62	0.03

**Table SD.3**

Detailed MG-DP-ILNS results of EVRPTW-RS-SMBS experiments on instances with 100 customers and 21 RSs

No.	Instance	V <sub>E</sub>	D <sub>E</sub>	V <sub>B</sub>	D <sub>B</sub>	S	V <sub>T</sub>	D <sub>T</sub>
1	C101-100	10	828.94	2	265.50	5	12	1094.44
2	C102-100	10	828.94	2	265.50	5	12	1094.44
3	C103-100	10	823.46	2	230.97	5	12	1054.43
4	C104-100	10	851.36	2	176.33	4	12	1027.69
5	C105-100	10	830.46	2	262.98	5	12	1093.44
6	C106-100	10	828.94	2	265.50	5	12	1094.44
7	C107-100	10	827.55	2	243.46	5	12	1071.01
8	C108-100	11	884.62	2	228.29	4	13	1112.92
9	C109-100	10	911.29	2	187.07	6	12	1098.37
10	C201-100	4	683.10	1	61.06	1	5	744.16
11	C202-100	4	677.48	1	47.98	2	5	725.46
12	C203-100	4	680.55	1	42.52	1	5	723.07
13	C204-100	4	690.80	1	61.06	1	5	751.85
14	C205-100	4	676.29	1	61.06	1	5	737.35
15	C206-100	4	772.26	0	0.00	0	4	772.26
16	C207-100	4	679.16	1	70.75	3	5	749.92
17	C208-100	4	710.56	0	0.00	0	4	710.56
18	R101-100	23	1761.11	3	302.73	11	26	2063.84
19	R102-100	20	1635.08	3	308.92	10	23	1944.01
20	R103-100	16	1312.01	3	317.10	12	19	1629.12
21	R104-100	15	1240.79	1	39.21	2	16	1280.00
22	R105-100	19	1533.39	2	182.44	8	21	1715.84
23	R106-100	17	1410.61	2	164.92	8	19	1575.53
24	R107-100	15	1251.58	2	178.59	5	17	1430.17
25	R108-100	12	1069.75	2	207.14	8	14	1276.89
26	R109-100	16	1314.21	2	218.70	8	18	1532.90
27	R110-100	14	1205.68	2	242.71	8	16	1448.40
28	R111-100	14	1233.64	3	217.46	10	17	1451.10
29	R112-100	15	1230.13	1	78.01	2	16	1308.15
30	R201-100	6	1634.63	0	0.00	0	6	1634.63
31	R202-100	5	1069.86	0	0.00	0	5	1069.86
32	R203-100	4	1093.77	0	0.00	0	4	1093.77
33	R204-100	4	785.81	0	0.00	0	4	785.81
34	R205-100	5	1001.75	0	0.00	0	5	1001.75
35	R206-100	4	940.36	0	0.00	0	4	940.36
36	R207-100	4	868.76	0	0.00	0	4	868.76
37	R208-100	3	773.04	0	0.00	0	3	773.04
38	R209-100	5	944.12	0	0.00	0	5	944.12
39	R210-100	4	1021.40	0	0.00	0	4	1021.40
40	R211-100	4	780.00	0	0.00	0	4	780.00
41	RC101-100	19	1806.84	2	279.27	7	21	2086.11
42	RC102-100	17	1669.22	2	318.06	8	19	1987.29
43	RC103-100	15	1512.94	1	139.86	4	16	1652.80
44	RC104-100	13	1317.43	1	110.55	3	14	1427.97
45	RC105-100	17	1650.40	3	317.25	10	20	1967.65
46	RC106-100	16	1547.29	2	209.33	8	18	1756.62
47	RC107-100	16	1488.77	1	156.80	4	17	1645.57
48	RC108-100	14	1401.35	2	191.10	8	16	1592.45

49	RC201-100	5	1482.87	0	0.00	0	5	1482.87
50	RC202-100	5	1207.72	0	0.00	0	5	1207.72
51	RC203-100	5	980.35	0	0.00	0	5	980.35
52	RC204-100	4	827.14	0	0.00	0	4	827.14
53	RC205-100	6	1275.21	0	0.00	0	6	1275.21
54	RC206-100	5	1117.68	0	0.00	0	5	1117.68
55	RC207-100	5	1032.56	0	0.00	0	5	1032.56
56	RC208-100	4	832.92	0	0.00	0	4	832.92

**Table SD.4**

Detailed MG-DP-ILNS results of EVRPTW-SMBS experiments on instances with 100 customers and 21 RSs

No.	Instance	V <sub>E</sub>	D <sub>E</sub>	V <sub>B</sub>	D <sub>B</sub>	S	V <sub>T</sub>	D <sub>T</sub>
1	C101-100	11	860.35	2	265.50	5	13	1125.85
2	C102-100	10	828.94	2	265.50	5	12	1094.44
3	C103-100	10	828.06	2	265.50	5	12	1093.56
4	C104-100	9	1226.23	3	331.45	12	12	1557.68
5	C105-100	10	830.46	2	262.98	5	12	1093.44
6	C106-100	11	859.82	2	244.78	5	13	1104.60
7	C107-100	10	827.55	2	243.46	5	12	1071.01
8	C108-100	11	895.21	2	232.04	5	13	1127.25
9	C109-100	11	901.81	2	237.68	6	13	1139.49
10	C201-100	4	641.99	1	137.05	4	5	779.03
11	C202-100	4	664.88	1	138.97	3	5	803.85
12	C203-100	4	672.07	1	143.24	4	5	815.31
13	C204-100	5	678.44	1	118.65	4	6	797.09
14	C205-100	4	658.49	1	144.25	3	5	802.74
15	C206-100	4	674.16	1	147.67	4	5	821.84
16	C207-100	4	655.80	1	139.09	4	5	794.89
17	C208-100	4	643.48	1	136.88	3	5	780.35
18	R101-100	24	1750.06	4	330.00	15	28	2080.06
19	R102-100	20	1621.03	4	407.75	16	24	2028.79
20	R103-100	16	1312.01	3	317.10	12	19	1629.12
21	R104-100	13	1186.59	3	267.80	11	16	1454.38
22	R105-100	18	1504.83	4	333.59	15	22	1838.41
23	R106-100	17	1456.46	4	345.52	16	21	1801.99
24	R107-100	16	1276.83	3	306.61	11	19	1583.43
25	R108-100	12	1149.01	3	299.61	12	15	1448.62
26	R109-100	17	1338.53	3	332.89	12	20	1671.43
27	R110-100	15	1257.19	3	305.89	11	18	1563.08
28	R111-100	16	1263.49	3	271.52	12	19	1535.01
29	R112-100	14	1184.94	3	288.91	12	17	1473.85
30	R201-100	7	1221.27	0	0.00	0	7	1221.27
31	R202-100	5	1255.92	1	43.40	3	6	1299.33
32	R203-100	4	940.94	1	65.43	4	5	1006.36
33	R204-100	4	779.39	0	0.00	0	4	779.39
34	R205-100	5	1005.35	1	36.40	2	6	1041.76
35	R206-100	4	920.58	1	74.15	4	5	994.74
36	R207-100	4	848.25	0	0.00	0	4	848.25
37	R208-100	3	757.39	1	47.22	3	4	804.61
38	R209-100	6	897.14	0	0.00	0	6	897.14
39	R210-100	4	958.64	1	63.01	4	5	1021.65
40	R211-100	4	780.00	0	0.00	0	4	780.00
41	RC101-100	19	1746.96	3	378.94	12	22	2125.90
42	RC102-100	16	1600.11	3	415.99	12	19	2016.10
43	RC103-100	15	1485.02	3	364.93	12	18	1849.95
44	RC104-100	12	1284.90	3	354.09	11	15	1638.98
45	RC105-100	19	1744.97	3	367.15	12	22	2112.12
46	RC106-100	16	1506.95	3	363.03	12	19	1869.98

47	RC107-100	15	1408.02	3	339.68	12	18	1747.69
48	RC108-100	14	1370.70	3	373.14	12	17	1743.84
49	RC201-100	5	1387.84	1	76.25	4	6	1464.09
50	RC202-100	5	1207.72	0	0.00	0	5	1207.72
51	RC203-100	5	1136.13	1	54.26	2	6	1190.39
52	RC204-100	4	853.56	1	109.55	4	5	963.11
53	RC205-100	6	1262.60	1	63.55	4	7	1326.15
54	RC206-100	5	1428.59	1	48.03	3	6	1476.62
55	RC207-100	5	1021.96	1	41.97	2	6	1063.92
56	RC208-100	4	859.30	1	128.12	4	5	987.41

**Table SD.5**

Detailed MG-DP-ILNS results of EVRPTW-RS experiments on instances with 100 customers and 21 RSs

No.	Instance	V <sub>E</sub>	D <sub>E</sub>	V <sub>B</sub>	D <sub>B</sub>	S	V <sub>T</sub>	D <sub>T</sub>
1	C101-100	-*	-	-	-	-	-	-
2	C102-100	-	-	-	-	-	-	-
3	C103-100	-	-	-	-	-	-	-
4	C104-100	16	1755.46	0	0	0	16	1755.46
5	C105-100	-	-	-	-	-	-	-
6	C106-100	16	1338.63	0	0	0	16	1338.63
7	C107-100	-	-	-	-	-	-	-
8	C108-100	16	1343.08	0	0	0	16	1343.08
9	C109-100	17	1469.47	0	0	0	17	1469.47
10	C201-100	6	966.39	0	0	0	6	966.39
11	C202-100	6	1014.46	0	0	0	6	1014.46
12	C203-100	6	1004.94	0	0	0	6	1004.94
13	C204-100	6	1576.88	0	0	0	6	1576.88
14	C205-100	6	993.09	0	0	0	6	993.09
15	C206-100	6	935.82	0	0	0	6	935.82
16	C207-100	6	1515.52	0	0	0	6	1515.52
17	C208-100	5	1019.43	0	0	0	5	1019.43
18	R101-100	29	2152.89	0	0	0	29	2152.89
19	R102-100	28	2200.76	0	0	0	28	2200.76
20	R103-100	21	1944.32	0	0	0	21	1944.32
21	R104-100	17	1560.58	0	0	0	17	1560.58
22	R105-100	26	1971.76	0	0	0	26	1971.76
23	R106-100	20	1645.73	0	0	0	20	1645.73
24	R107-100	20	2166.24	0	0	0	20	2166.24
25	R108-100	17	1669.47	0	0	0	17	1669.47
26	R109-100	22	2157.61	0	0	0	22	2157.61
27	R110-100	19	1620.67	0	0	0	19	1620.67
28	R111-100	19	1760.93	0	0	0	19	1760.93
29	R112-100	16	1478.90	0	0	0	16	1478.90
30	R201-100	6	1634.63	0	0	0	6	1634.63
31	R202-100	5	1069.86	0	0	0	5	1069.86
32	R203-100	4	1093.77	0	0	0	4	1093.77
33	R204-100	4	779.39	0	0	0	4	779.39
34	R205-100	5	1001.75	0	0	0	5	1001.75
35	R206-100	4	940.36	0	0	0	4	940.36
36	R207-100	4	825.57	0	0	0	4	825.57
37	R208-100	3	773.04	0	0	0	3	773.04
38	R209-100	5	944.12	0	0	0	5	944.12
39	R210-100	4	1021.40	0	0	0	4	1021.40
40	R211-100	4	780.00	0	0	0	4	780.00
41	RC101-100	-	-	-	-	-	-	-
42	RC102-100	21	1974.36	0	0	0	21	1974.36
43	RC103-100	20	1933.39	0	0	0	20	1933.39
44	RC104-100	17	1735.48	0	0	0	17	1735.48



45	RC105-100	22	2264.44	0	0	0	22	2264.44
46	RC106-100	22	2047.82	0	0	0	22	2047.82
47	RC107-100	19	1986.02	0	0	0	19	1986.02
48	RC108-100	17	1845.65	0	0	0	17	1845.65
49	RC201-100	5	1482.87	0	0	0	5	1482.87
50	RC202-100	5	1207.72	0	0	0	5	1207.72
51	RC203-100	5	980.35	0	0	0	5	980.35
52	RC204-100	4	827.14	0	0	0	4	827.14
53	RC205-100	6	1275.21	0	0	0	6	1275.21
54	RC206-100	5	1117.68	0	0	0	5	1117.68
55	RC207-100	5	1032.56	0	0	0	5	1032.56
56	RC208-100	4	832.92	0	0	0	4	832.92

---

\*No feasible solution is found for the given instance under the setting of EVRPTW-RS

---