

## I. APPENDIX

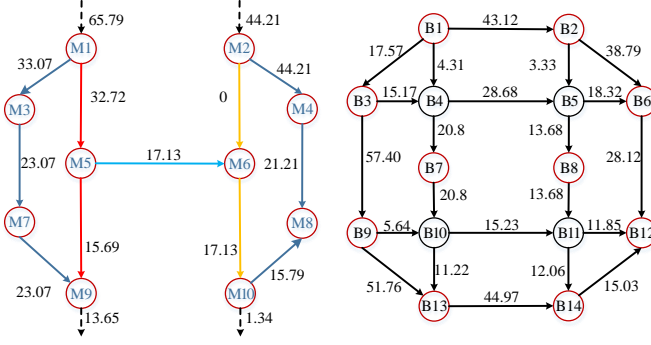


Fig.a1. Traffic flow distribution of MN and RETN at initial time

Table A1

O-D PAIRS AND THEIR LOADS OF RTN

O-D	$q_{rs}^0$ (p.u.)	O-D	$q_{rs}^0$ (p.u.)
B1-B6	15	B3-B13	8
B1-B12	25	B3-B14	12
B1-B13	10	B4-B11	5
B1-B14	15	B4-B12	10
B3-B6	15	B4-B14	15
B3-B12	20		

Table A2

LINKS PARAMETERS OF RTN

Link	$c_e$ (p.u.)	$t_{eh}^0$ (min)	Link	$c_e$ (p.u.)	$t_{eh}^0$ (min)
B1-B3	18	12	B6-B12	20	21
B1-B2	30	20	B7-B10	28	23
B2-B6	22	13	B8-B11	13.8	25
B1-B4	15	10	B9-B10	8.9	11.6
B2-B5	7.9	11	B10-B11	13.2	22
B3-B4	10.5	12	B11-B12	9.15	11.8
B4-B5	27	24	B9-B13	35	12.6
B4-B7	28	23	B10-B13	10	11.4
B5-B6	9.2	13	B11-B14	15	11.6
B3-B9	36	20.4	B13-B14	30	19.6
B5-B8	13.8	25	B14-B12	18.2	12.2

Table A3

O-D PAIRS AND THEIR LOADS IN MTN

O-D	$D_w^0$ (p.u.)	O-D	$D_w^0$ (p.u.)
M1-M3	10	M2-M4	23
M1-M9	25	M2-M8	37

Table A4

PARAMETERS OF LINKS OF MTN

Link	$c_e$ (p.u.)	$t_{em}^0$ (min)	Link	$c_e$ (p.u.)	$t_{em}^0$ (min)
M1-M3	50	6	M5-M6	45	6
M1-M2	85	10	M5-M9	55	6.5
M2-M4	75	6.5	M6-M10	60	6
M1-M5	55	5	M7-M9	55	11.5
M2-M6	45	5.5	M8-M10	50	12.5
M3-M7	65	6	M9-M10	45	5.8

Table A5

GENERATORS PARAMETERS

Source	Node	$PG^{min}$	$PG^{max}$	$QG^{min}$	$QG^{max}$	$V_0$
Main Grid	P0	0.5	0.25	0	-0.1	1.0504
DG1	P32	0.05	0.015	0	-0.01	1.0218
DG2	P31	0.05	0.025	0	-0.01	1.0359
DG3	P33	0.06	0.03	0	-0.01	1.0429

Table A6

BRANCHES PARAMETERS OF DPN

Branch	$r$	$x$	$\bar{S}_{ij}$	Branch	$r$	$x$	$\bar{S}_{ij}$
P1-P2	0.086	0.054	0.1903	P16-P19	0.079	0.029	0.0121
P2-P3	0.159	0.059	0.0957	P17-P18	0.508	0.188	0.0347
P3-P31	0.088	0.046	0.0545	P19-P33	0.098	0.051	0.056
P31-P4	0.119	0.074	0.0063	P19-P20	0.079	0.029	0.037
P31-P5	0.095	0.035	0.0642	P1-P21	0.127	0.066	0.1555
P5-P6	0.147	0.076	0.0271	P21-P22	0.206	0.076	0.0444
P6-P7	0.032	0.012	0.027	P21-P24	0.365	0.135	0.1024

P2-P8	0.196	0.102	0.0371	P22-P23	0.147	0.076	0.037
P2-P9	0.029	0.018	0.0537	P24-P25	0.069	0.036	0.0672
P9-P10	0.095	0.035	0.0075	P25-P26	0.049	0.025	0.0653
P10-P32	0.111	0.041	0.026	P26-P27	0.157	0.081	0.0282
P9-P11	0.302	0.112	0.0461	P27-P28	0.079	0.029	0.0211
P11-P12	0.048	0.018	0	P1-P29	0.206	0.076	0.0318
P11-P13	0.078	0.041	0.0316	P29-P30	0.206	0.076	0.0317
P1-P14	0.018	0.011	0.1381	P9-P14	0.004	0.015	0.0895
P14-P15	0.127	0.047	0.0336	P6-P30	0.004	0.015	0.0253
P14-P16	0.147	0.076	0.0674	P0-P1	0.004	0.015	0.517
P16-P17	0.078	0.041	0.0718				

Table A7

NODE PARAMETERS OF DPN

Node	$PD_i$	$QD_i$	$\omega_i$	Node	$PD_i$	$QD_i$	$\omega_i$
P1	0	0	-	P18	0.021	0.009	0
P2	0.001	0.0005	1	P19	0.0042	0.0021	1
P3	0.024	0.012	100	P20	0.022	0.011	100
P4	0.0038	0.0018	1	P21	0.0042	0.0021	1
P5	0.0161	0.008	1	P22	0.0042	0.0021	1
P6	0	0	-	P23	0.022	0.011	100
P7	0.022	0.011	100	P24	0.023	0.0012	1
P8	0.022	0.011	100	P25	0.001	0.0005	1
P9	0	0	-	P26	0.022	0.011	100
P10	0.02	0.01	100	P27	0.0042	0.0021	1
P11	0.0085	0.004	1	P28	0.0126	0.0062	1
P12	0	0	-	P29	0	0	-
P13	0.019	0.009	1	P30	0.019	0.009	1
P14	0.022	0.011	100	P31	0.0042	0.0021	1
P15	0.02	0.01	100	P32	0.0126	0.0063	1
P16	0.0042	0.0021	0	P33	0	0	-
P17	0.022	0.011	100	P0	0	0	-

Table A8

EB PARAMETERS

$N_B$	$\frac{n_{ch}}{p_{mt}} / \frac{n_{dch}}{p_{mt}}$	$\eta_m^{ch} / \eta_m^{dch}$	$E_m$	$soc_m / soc_m$	$p_m^n / p_m^{n_2}$
30	120/100kW	0.95	300kWh	20%/85%	30kW

Table A9

CAPACITIES AND GEOGRAPHIC LOCATIONS OF FCSs

Failed line	FCS1	FCS2	FCS3	FCS4
Capacity	20	20	20	20
Location	B3	B9	B11	B8

Table A10

RECOVER TIME  $T_{s_i}^{ch}$  AND GEOGRAPHIC LOCATIONS OF FAILED LINES

Failed line	P6-P7	P0-P1	P24-P25	P1-P14	P2-P8	P31-P5
Time( $\Delta T$ )	2 $\Delta T$	6 $\Delta T$	2 $\Delta T$	2 $\Delta T$	2 $\Delta T$	2 $\Delta T$
Location	B6	B7	B11	B3	B2	B5

Table A11

NODAL LOADS OF DPN AFTER LOAD SHEDDING IN THE EXTREME SCENARIO

Node	$PD_i$	Node	$PD_i$	Node	$PD_i$
P1	0	P13	0	P25	0
P2	0	P14	0	P26	0
P3	0.024	P15	0	P27	0
P4	0	P16	0.0042	P28	0
P5	0	P17	0	P29	0
P6	0	P18	0	P30	0
P7	0	P19	0.0042	P31	0.0042
P8	0	P20	0.022	P32	0.0126
P9	0	P21	0	P33	0
P10	0.02	P22	0	P0	0
P11	0.006	P23	0.022		
P12	0	P24	0		

Table A12

OPERATION TIME OF ORIGINAL ROUTES

No	Original route	Operation time
$R_o^1$	B1-B2-B6-B12	6 $\Delta T$
$R_o^2$	B1-B2-B5-B6-B12	6 $\Delta T$
$R_o^3$	B1-B2-B5-B8-B11-B12	8 $\Delta T$
$R_o^4$	B3-B9-B13-B14	6 $\Delta T$