



LODF Screening Tool



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LODF Screening



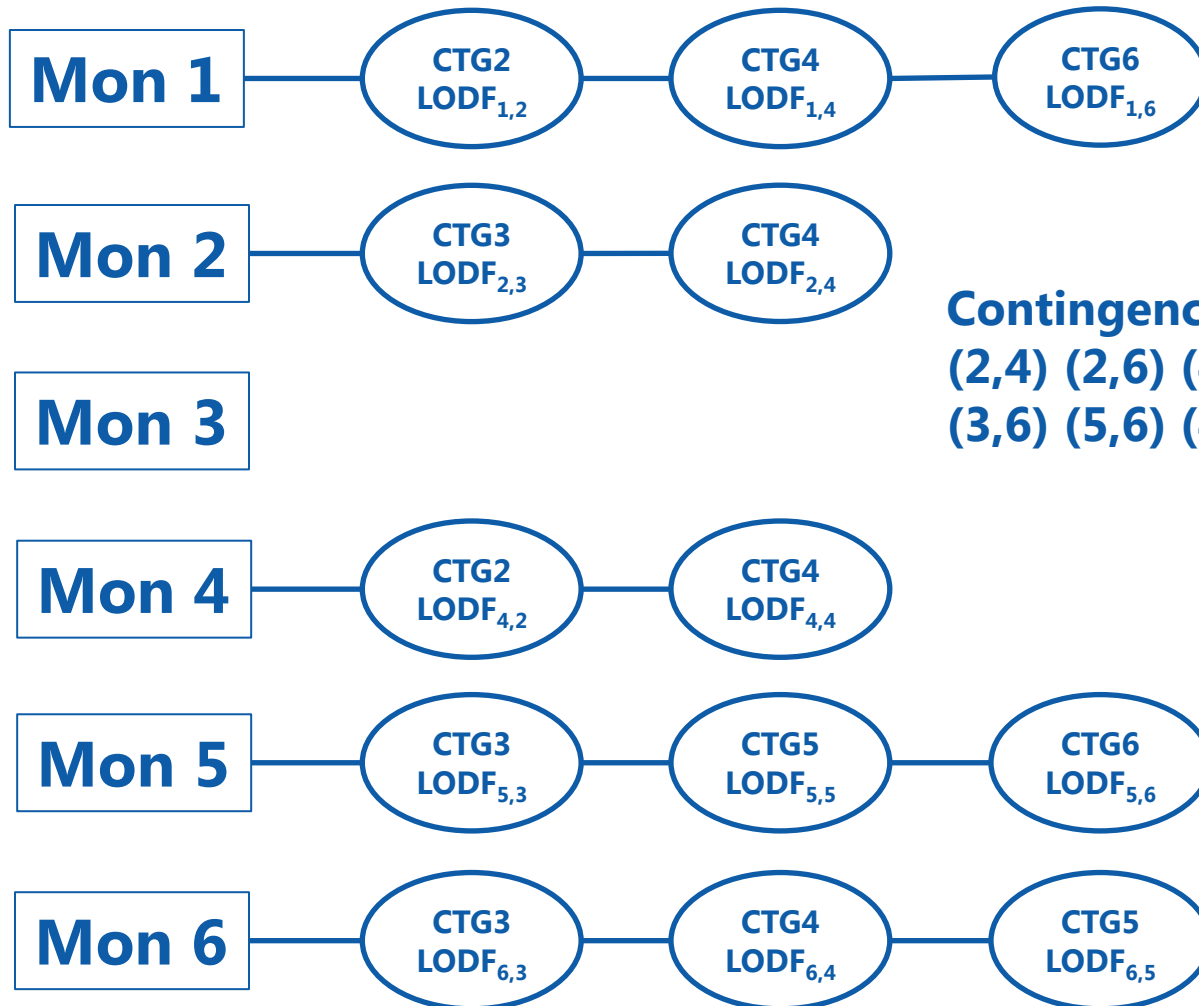
- New tool in Simulator based on technical paper
 - C. Matthew Davis and Thomas J. Overbye, “Multiple Element Screening,” *IEEE Transactions on Power Systems*, vol. 26, no. 3, pp. 1294-1301, Aug. 2011
- Create pairs of contingencies that are significant without solving all contingencies

Screening Methods



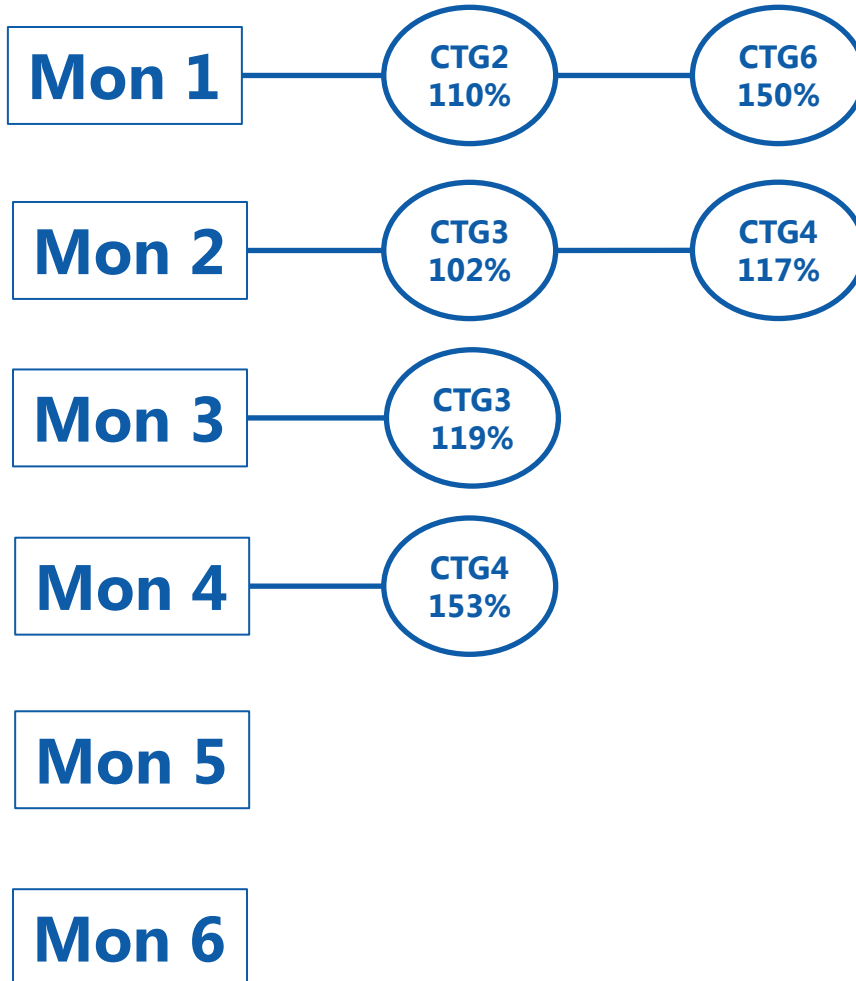
- Impact Tracking Structure (ITS)
 - Use LODFs to determine significant single contingencies for monitored elements based on the magnitude of the LODF
 - Create pairs of significant contingencies from single contingencies that impact a single monitored element
- Overload Tracking Structure (OTS)
 - Use LODFS to determine significant loadings on monitored elements due to a single contingency
 - Create pairs of significant contingencies from any single contingency that causes an overload and all other single contingencies

Impact Tracking Structure (ITS)



Contingency Pairs Formed:
(2,4) (2,6) (4,6) (3,4) (3,5)
(3,6) (5,6) (4,5)

Outage Tracking Structure (OTS)



Contingency Pairs Formed:
(1,2) (2,3) (2,4) (2,5) (2,6)
(1,6) (3,6) (4,6) (5,6)
(1,3) (3,4) (3,5)
(1,4) (4,5) (4,6)

LODF Screening Dialog



Sensitivities

Power Transfer Distribution Factors (PTDFs)...

ILR Sensitivities / Generation Shift Factors...

Line Outage Distribution Factors (LODFs)...

LODF Screening...

Flow and Voltage Sensitivities...

Loss Sensitivities...

LODF Screening

Lines to Process (Outage)

All ac Lines
 Defined Contingencies
 Limit Monitoring Settings
 Use Area/Zone/Owner Filter

Use Selected
 Meets Filter

Options

Include Phase Shifters
 Include Open Lines
 LODF Threshold
 Overload Threshold Between and

Lines to Monitor

Same as Lines to Process
 All ac Lines
 Limit Monitoring Settings
 Use Area/Zone/Owner Filter

Use Selected
 Meets Filter

Calculate

Finished Calculating LODFs

File Information

File Location:

Summary Information

Number of Lines to Process: Number of Combinations Without Screening:
 Number of Lines to Monitor: Processing Time:
 Number of CTG Combinations:

Summary

	Contingency Line	Highest LODF	Highest LODF Line	Highest Overload	Highest Overload Line
1	BOUNDRYE_230 SACHEEN_230	78.72	BELL S1_230' SACHEEN_230		
2	OKANOGAN_115' OPHIR T_11	100.00	BREWSTER_115' OPHIR T_11		
3	LYNDEN_115 SCHUETT_115 1	100.00	BELNGM P_115' BRITTON_115		
4	'SEDRO W_115' BAKER SW_1	-100.00	'BAKER SW_115' HAMILTNP_1		
5	PROSPECT_69.0 PROSPECT_	100.00	'DODGE BR_69.0' FRALEY_69.		
6	MARINER_115' SILVE LK_115'	-100.00	'SNOK S1_115' NCRK TAP_11		
7	COMM_BAY_115 ST_PAUL_11	-100.00	BLAIR_115 LINCLNTA_115 1		
8	A8_230 MIDWAYB1_230 1	-100.00	A6_230 A8_230 1		
9	'CUSTER W_230' PORTALWY_	72.48	'CUSTER W_230' CUSTER E_2		
10	GRANDVEW_115 SUNYTP_115	-100.00	'BENTON C_115' CHANDLER_1		
11	KRAINCOR_57.5 STEVNSON_	100.00	BUCKLEY_57.5 STEVNSON_57		
12	ROCHEST_115 TONOROCT_1	100.00	'TONO PHA_115' TONOROCT_		
13	ESTACAD2_59.8 FARADAY_59	-100.00	BORING_59.8 EAGLCRK1_59.		
14	'SO NILE_115' RAPIDS_115 1	-100.00	EASTMONT_115' SO NILE_115		
15	JULIAETT_115 OROFINO_115	100.00	JULIAETT_115 MOSCOW_115		
16	ALVEY_115' TENTH ST_115' 1	66.81	'SPRING B_115' TENTH ST_11		
17	BELL S3_230' BELL S4_230' 1	-94.20	BELL S2_230' BELL S3_230' 1		

Dialog Options



- Lines to Process
 - *All ac Lines*
 - *Defined Contingencies*
 - Any branch outage or closure will be taken as a single contingency
 - *Limit Monitoring Settings*
 - Any branch that is set to be monitored based on the Limit Monitoring Settings will be taken as a single contingency
 - *Use Area/Zone/Owner Filter*
 - *Use Selected*
 - Branches with the Selected field equal to YES
 - *Meets Filter*
 - Specify an Advanced Filter to select the branches

Dialog Options



- Lines to Monitor
 - *Same as Lines to Process*
 - The monitored set will be the same as the outaged set of lines
 - *All ac Lines*
 - *Limit Monitoring Settings*
 - Any branch that is set to be monitored based on the Limit Monitoring Settings will be monitored
 - *Use Area/Zone/Owner Filter*
 - *Use Selected*
 - Branches with the Selected field equal to YES
 - *Meets Filter*
 - Specify an Advanced Filter to select the branches

Dialog Options



- Include Phase Shifters
 - Check this option to treat the flow on phase shifters as constant, i.e. LODF = 0 on phase shifters
- Include Open Lines
 - LCDF values can be calculated along with LODFs
 - If checked the impact of closing lines will be included in the ITS and OTS screening

Dialog Options



- LODF Threshold
 - Check this option to do the ITS screening
 - Specify the LODF threshold
 - Minimum is 1%
- Overload Threshold
 - Check this option to do the OTS screening
 - Specify a range of loading

Other Settings



- Limit Monitoring Settings
 - Contingency Rating Set determines the limit used in calculating line loadings for OTS tracking

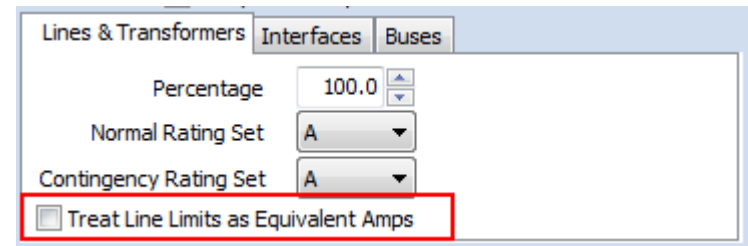
The screenshot shows a software interface with three tabs: 'Lines & Transformers', 'Interfaces', and 'Buses'. The 'Interfaces' tab is active. It contains the following settings:

- Percentage: 100.0 (with up/down arrows)
- Normal Rating Set: A (dropdown menu)
- Contingency Rating Set: A (dropdown menu, highlighted with a red box)
- Treat Line Limits as Equivalent Amps

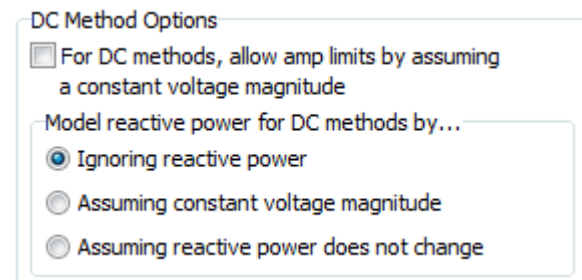
Other Settings



- Contingency Options
 - For DC methods, allow amp limits by assuming a constant voltage magnitude
 - Must also set the amps option with the Limit Monitoring Settings



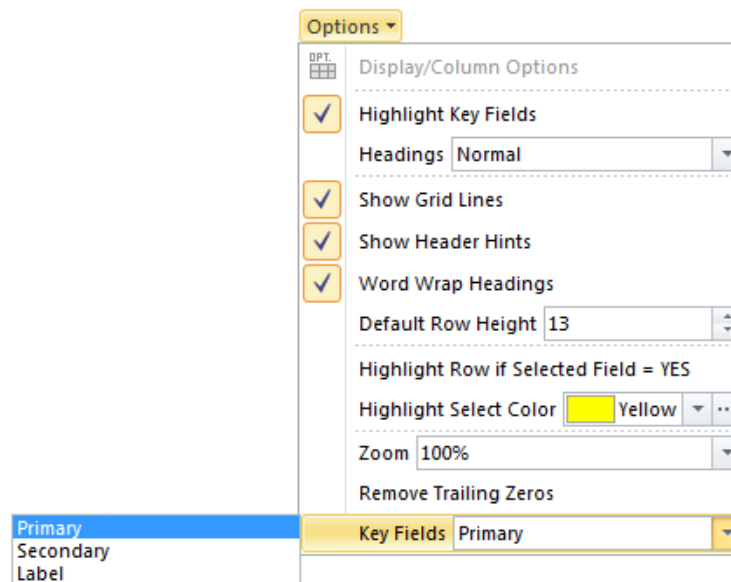
- Model reactive power for DC methods



Other Settings



- Key Field selection
 - This applies to the identifiers used in the Summary table as well as the branch identifiers in the auxiliary file



Other Settings



- Auto Insert Contingency Options
 - Determine how the contingencies will be named
 - Identify lines using prefix
 - Identify transformers using prefix
 - Identify buses by

Naming Options

Identify lines using prefix	L_
Identify transformers using prefix	T_

Identify buses by

Numbers

Names

Both

Labels (Use Numbers if no label)

Include Nominal Voltages

Calculating Loading



- MW_m - MW flow on monitored line m
- MW_c - MW flow on contingency line c
- $LODF_{m,c}$ - LODF on monitored line m due to contingency c
- $Limit_m$ - Contingency MVA rating on monitored line m
 - For multi-section lines only the first section is monitored
 - *Limit* is the lowest non zero contingency MVA rating from all sections
- $OMW_{m,c}$ - Post-contingency MW flow on monitored line m due to contingency c (*From* and *To* indicate flows at the from and to ends of the line)
 - $OMWFrom_{m,c} = MWFrom_m + MW_c \cdot LODF_{m,c}$
 - $OMWTo_{m,c} = MWTo_m - MW_c \cdot LODF_{m,c}$
- $OMVA_{m,c}$ - Post-contingency MVA flow determined from $OMW_{m,c}$ and the option on how to model reactive power
 - $OMVA_{m,c}$ can optionally be converted to amps
- Largest $OMVA_{m,c}$ at either the from or to bus determines the loading
 - $\left(\frac{OMVA_{m,c}}{Limit_m} \right) \cdot 100$ – Percent loading used in OTS screening

File Options



- File Location
 - Specify the directory where the contingency file should be stored
 - Default file name is *LODFScreening.aux*
 - A local directory rather than a network directory will be quicker especially if there are a large number of contingencies
- Save to File
 - Click this button to actually create the aux file with the contingency pairs

Auxiliary File



- Saved as CONTINGENCYELEMENT object type
 - Contingencies stored as individual elements

```
LODFScreening.aux - Notepad
File Edit Format View Help
DATA (CONTINGENCYELEMENT, [CTGLabel,FilterName,Action,Object])
{
"L_045087DELTA-031468CASCADEC1L_040013ACTON-040139BONNVILEC1" "" "OPEN" "BRANCH 'DELTA_115' 'CASCADE_115' 1"
"L_045087DELTA-031468CASCADEC1L_040013ACTON-040139BONNVILEC1" "" "OPEN" "BRANCH 'ACTON_115' 'BONNVILE_115' 1"
"L_045087DELTA-031468CASCADEC1L_040013ACTON-040187CASCDLKC1" "" "OPEN" "BRANCH 'DELTA_115' 'CASCADE_115' 1"
"L_045087DELTA-031468CASCADEC1L_040013ACTON-040187CASCDLKC1" "" "OPEN" "BRANCH 'ACTON_115' 'CASCD LK_115' 1"
"L_045087DELTA-031468CASCADEC1L_040015ADAIR-040025ALBANYC1" "" "OPEN" "BRANCH 'DELTA_115' 'CASCADE_115' 1"
"L_045087DELTA-031468CASCADEC1L_040015ADAIR-040025ALBANYC1" "" "OPEN" "BRANCH 'ADAIR_115' 'ALBANY_115' 1"
"L_045087DELTA-031468CASCADEC1L_040015ADAIR-041010SOUTHMC1" "" "OPEN" "BRANCH 'DELTA_115' 'CASCADE_115' 1"
"L_045087DELTA-031468CASCADEC1L_040015ADAIR-041010SOUTHMC1" "" "OPEN" "BRANCH 'ADAIR_115' 'SOUTH M_115' 1"
"L_045087DELTA-031468CASCADEC1T_040027ALBANY-040025ALBANYC1" "" "OPEN" "BRANCH 'DELTA_115' 'CASCADE_115' 1"
"L_045087DELTA-031468CASCADEC1T_040027ALBANY-040025ALBANYC1" "" "OPEN" "BRANCH 'ALBANY_230' 'ALBANY_115' 1"
"L_045087DELTA-031468CASCADEC1L_040025ALBANY-040273CONSERC1" "" "OPEN" "BRANCH 'DELTA_115' 'CASCADE_115' 1"
"L_045087DELTA-031468CASCADEC1L_040025ALBANY-040273CONSERC1" "" "OPEN" "BRANCH 'ALBANY_115' 'CONSER_115' 1"
"L_045087DELTA-031468CASCADEC1L_040025ALBANY-045131HAZELWODC1" "" "OPEN" "BRANCH 'DELTA_115' 'CASCADE_115' 1"
"L_045087DELTA-031468CASCADEC1L_040025ALBANY-045131HAZELWODC1" "" "OPEN" "BRANCH 'ALBANY_115' 'HAZELWOD_115' 1"
"L_045087DELTA-031468CASCADEC1L_040027ALBANY-040939SANTIAMC1" "" "OPEN" "BRANCH 'DELTA_115' 'CASCADE_115' 1"
"L_045087DELTA-031468CASCADEC1L_040027ALBANY-040939SANTIAMC1" "" "OPEN" "BRANCH 'ALBANY_230' 'SANTIAM_230' 1"
"L_045087DELTA-031468CASCADEC1L_040031ALCOA-041035STEVNTPC1" "" "OPEN" "BRANCH 'DELTA_115' 'CASCADE_115' 1"
"L_045087DELTA-031468CASCADEC1L_040031ALCOA-041035STEVNTPC1" "" "OPEN" "BRANCH 'ALCOA_115' 'STEVN TP_115' 1"
"L_045087DELTA-031468CASCADEC1L_040039ALFALFA-045229OUTLOOKC1" "" "OPEN" "BRANCH 'DELTA_115' 'CASCADE_115' 1"
"L_045087DELTA-031468CASCADEC1L_040039ALFALFA-045229OUTLOOKC1" "" "OPEN" "BRANCH 'ALFALFA_230' 'OUTLOOK_230' 1"
"L_045087DELTA-031468CASCADEC1L_040039ALFALFA-047851LITLBUCKC1-MS" "" "OPEN" "BRANCH 'DELTA_115' 'CASCADE_115' 1"
"L_045087DELTA-031468CASCADEC1L_040039ALFALFA-047851LITLBUCKC1-MS" "" "OPEN" "BRANCH 'ALFALFA_230' 'LITLBUCK_230' 1 1"
"L_045087DELTA-031468CASCADEC1L_040045ALSTON-040601KEELEDG1" "" "OPEN" "BRANCH 'DELTA_115' 'CASCADE_115' 1"

```

Summary Information



- Number of Lines to Process
 - Number of lines found based on the **Lines to Process** option and the **Include Open Lines** option
- Number of Lines to Monitor
 - Number of lines found based on the **Lines to Monitor** option
 - Only closed lines are monitored

Summary Information



- Number of CTG Combinations
 - Number of contingencies that will be created if you save contingencies to file
- Number of Combinations Without Screening
 - Number of contingencies that would be created if you takes the **Number of Lines to Process** in combinations of 2 contingencies
- Processing Time
 - Number of seconds that it takes to do the ITS and/or OTS screening

Summary Table



- Lists the single contingencies that have an LODF greater than the **LODF Threshold** and/or create an overload within the **Overload Threshold**
 - The highest LODF %, branch with the highest LODF, highest overload %, and branch with the highest overload are listed
- The entire tracking structure is not available to minimize computer memory usage