Mapping Flowchart for Existing Vulnerability Matrices

The objective of this flowchart is to aid in the mapping of policies to existing vulnerability matrices(VM). The chart is divided into independent lettered parts that are used to generate a name for the corresponding vulnerability matrix. Each lettered part must be performed individually to classify a label for that particular parameter which will be used to obtain the VM's entire unique name:

For Instance, Part A determines the exterior wall of the policy and assigns the corresponding label to that wall type. The label is then imputed into the vulnerability matrix name for the parameter "exterior wall". So, say for instance the exterior wall is timber- the corresponding label is "tbr" then the Vulnerability matrix parameter slot for exterior wall becomes "tbr".

So:

VM_model_type_exteriorwall_region_subregion_strength_story_roofshape_roofcover_decking_R2W_S2S_underlayment_garagedoor_doorprotection_openingprotection_shape_daterun.

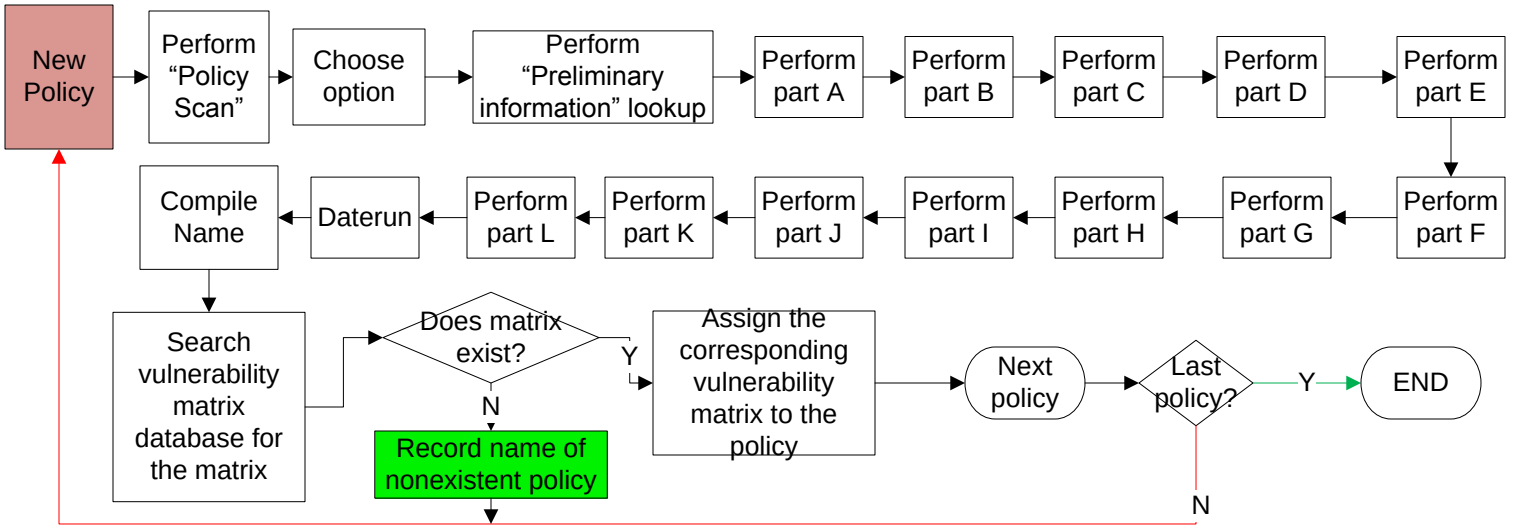
Becomes:

VM_model_type_Tbr_region_subregion_strength_story_roofshape_roofcover_decking_R2W_S2S_underlayment_garagedoor_doorprotection_openingprotection_shape_daterun.

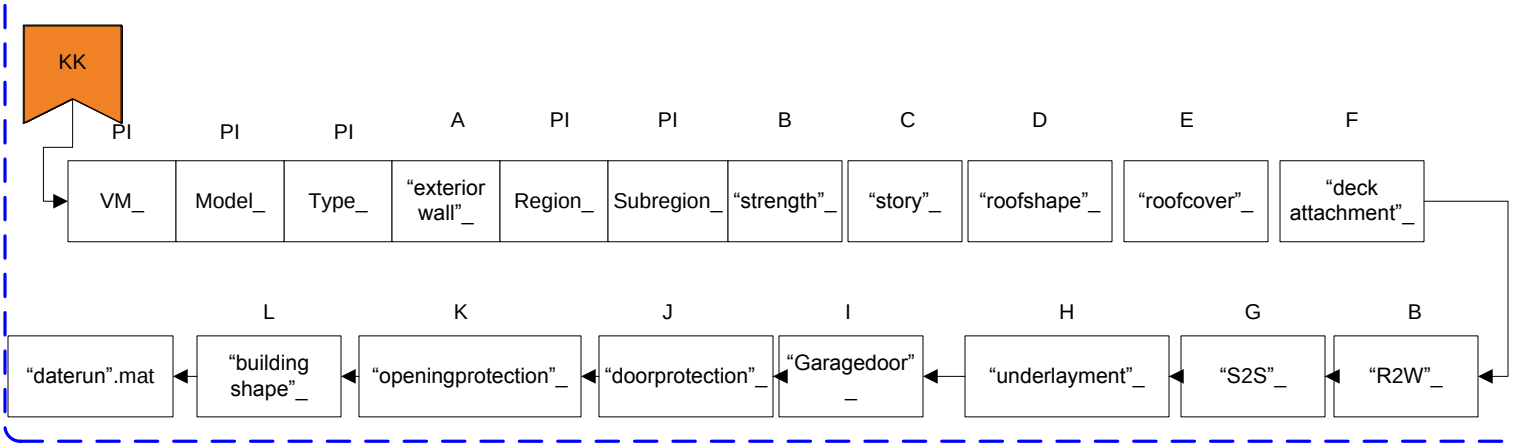
then one proceeds to the next parts to determine the rest of the parameters. Once all the parameters are either assigned or a weighting option has been defined then a name can be generated and compared to the existing library. Some lettered parts will determine labels for multiple parameters for instance the R2W connection check will be used to define a strength so both "strength" and "R2W" labels will be assigned (part B).

It is assumed that at a minimum, the policy will indicate the year built, the exterior wall and zip code information. From the zip code, parameters in the name such as region and subregion will be known.

Outline



Vulnerability matrix name generator



Supplementary Information:

V1.1 For this Flow chart to work, additional documents need to be implemented. A companion file has all the Probabilities and conditional probabilities for each county and region. A run date excel file will be provided along with the FTP file path. Additionally, not all portfolio's use the same name types so refer to engineering team for equivalents

Information like a Florida wind zone map, zip code geographical locations and south, central, and north boundary locations will be required for adequate policy mapping.

The process initializes two options which the user can define. Option 1 allows the user to jump to a corresponding weighted matrix if they decide that not enough parameters are available.
Option 2 defines each parameter until a name is compiled based on the parameter. In cases were parameters are missing (and there is statistics available for that parameter) a probability distribution function is implemented for that parameter based on county statistics. In cases where no statistics are available, strength checks (SC) ,or in some cases, default values are implemented to determine the missing parameters

For Parts A-K always start at the Blue square and end at the orange off page reference marked (KK). Once a parameter has been determine, move on to the next part.

V1.2 Updates to the existing mapping flowchart were required to meet concerns of Actuarial team as well as corrections to minor errors.

Modifications include:

- Assignment of "other" matrices in the instance where exterior wall type is "other" previously the policy was skipped.
- For Roof shape = "flat" or "other" , assign a weighted matrix (if exterior wall is known, then use that weighted matrix if not, assign weighted matrix from that region for the era the building was built in)
- For roof cover, the engineering team does not model Metal roof cover so if roof cover is metal- assign shingles and follow the reroofing tab guidelines for rating classification.
- All parameters for which statistics are not available and are classified as "other" than the listed cases- follow the procedure as if "unknown." This ensures that a strength check will be performed and an equivalent parameter will be assigned based on the age of the building.
- Shutters considered as "other" are modeled as plywood.

V1.3 Updates.

Logic in reroofing tab was adjusted with regard to the cut off dates. 2001 was changed to 2002
Also region = keys was added to the HVHZ region in stochastic analysis as it was accidently neglected in the previous version.

Version 2.1 Updates

Modifications to V 1.3 for V2.1:

- In V 1.3, Certain portfolios had information available which made up illogical combinations i.e. strong models with un-braced gable ends or unreinforced masonry walls. The solution to this problem was to force certain parameters to be governed by their strength classification rather than what the portfolio policy claims that they are. i.e. a strength check is placed after the assignment of a certain parameter to ensure that a known parameter matches with the available logical strength configurations. E.g. for the exterior wall classification a previous check was used to determine if the masonry walls were reinforced. If the policy stated that they were reinforced but the rest of the model was weak then the name generated would not exist. The reinforced check was thus removed and a strength check was placed there instead as to force all weak models to be unreinforced and all strong and medium models to be reinforced. Similarly, this modification was done fore gable ends and garage doors so that strength governed the outcome.
- Lettered parts “A” and “B” were reordered since the strength assignment of the old Part B was needed for the old part A. hence, the new “Part A” is the R2W and strength assignment and Part B is the exterior wall assignment.
- For Parts E and F, (roof cover and deck attachment) the strength check is implemented for all known and unknown cases of shingle’ ratings and deck attachments respectively. For all cases of shingles where the rating is unknown or known and deck attachment, the strength check and reroofing logic make sure that no illogical or non-existent combinations were created from these two parameters.
- Certain parameter classifications were changed since currently the vulnerability matrix library does not include these parameters. Namely
    1) underlayment = “extra” is now set to underlayment = “reg”. but may be reinstated in the future once the engineering team models additional secondary water barriers.
    2) mitigated glass in part K was changed from “stlSht” to “plySht” since this was a typo in the previous version
- On the reroofing tab, for a scenario analysis the inequalities with YB + 20t had an error with the range of t since they started at 1 and did not include YB = 1994 to 2014 and 2002 to 2012 where t = 0. so the range values of “t” was modified to include “0”. So values of t become: (t= 0,1,2,3...n)

Version 2.2 Updates

V2.2 (June 2012)

V2.1 of the Mapping Flow chart accounts for additional models and parameters included in the FPHLM personal residential vulnerability matrix library as of June 2012

Modifications include:

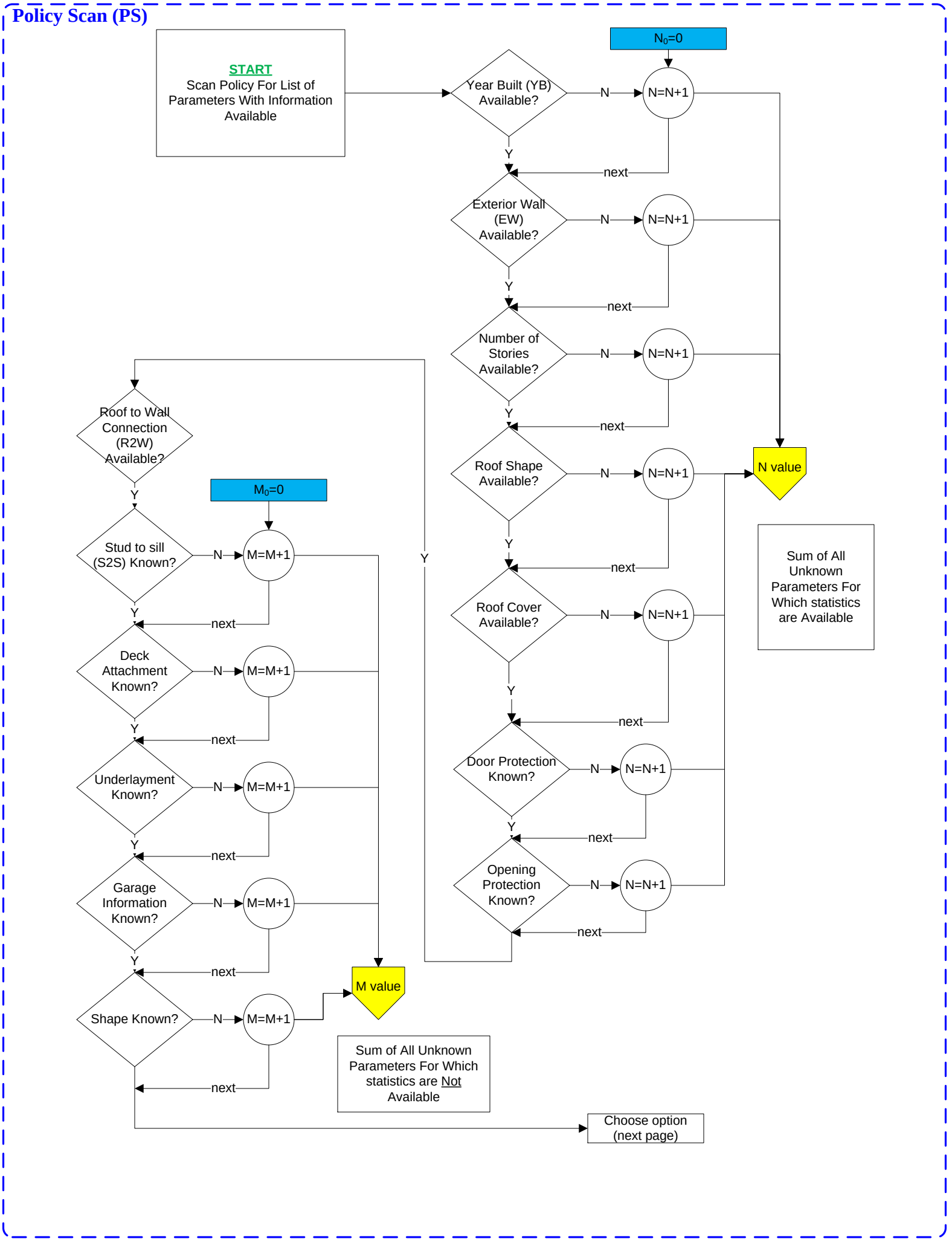
- Metal shutters have been developed for all model cases and are assigned “aluSht” in the naming convention. – mitigated glass is also assigned as aluSht
- Stronger HVHZ models were developed so decking assignments and roof cover assignments have been modified to include HVHZ rated shingles (shngH) and a stronger deck attachment of ring shank nails at 6" O.C. for both the field and edge spacing. (the label of RS6 has been adopted for these cases. This however, is subject to change in the future.)
- Metal roof cover has now been developed for all models except M10 and W10 for the state. Strong metal roof models have the RS6 deck attachment assignment regardless of subregion
- The use of shutters is no longer limited to only 1 story models so both 1 and 2 story cases have 3 brands of protection (i.e. none, plywood or aluminum)
- For the HVHZ Strong models the roof to wall connection (R2W) has been modeled as double straps (the label however does not reflect this at the moment and is simply stp)
- Weighted Table now reflects different grades of Strong Models such as:
    - S00- represents base strong (rated shingles, 8d6 decking and single straps.)
    - S01- represents HVHZ strong (HVHZ rated Shingles, RS6 decking and double straps)
    - S02- represents Strong metal roof models with RS6 decking and single straps.

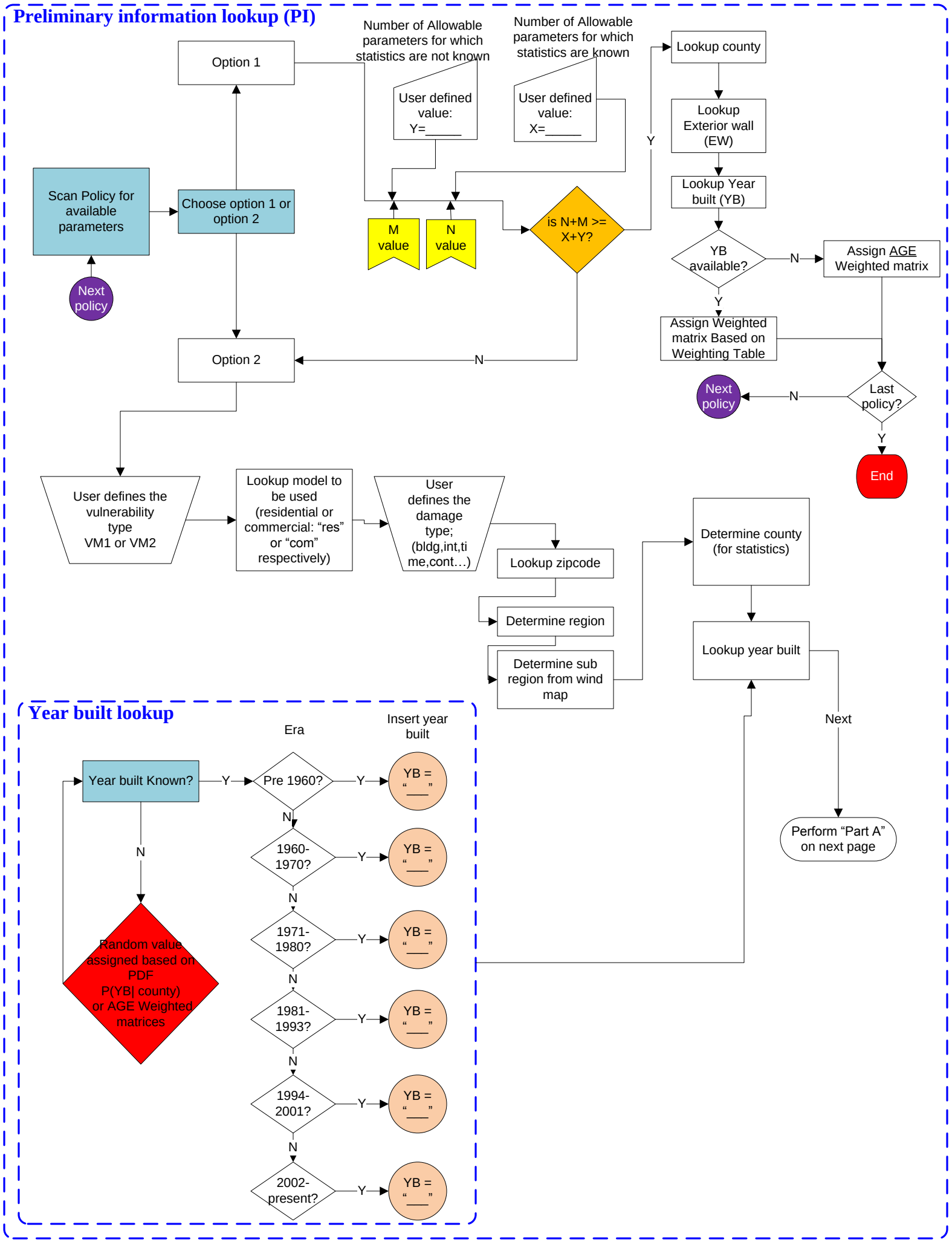
Version 2.3 Updates

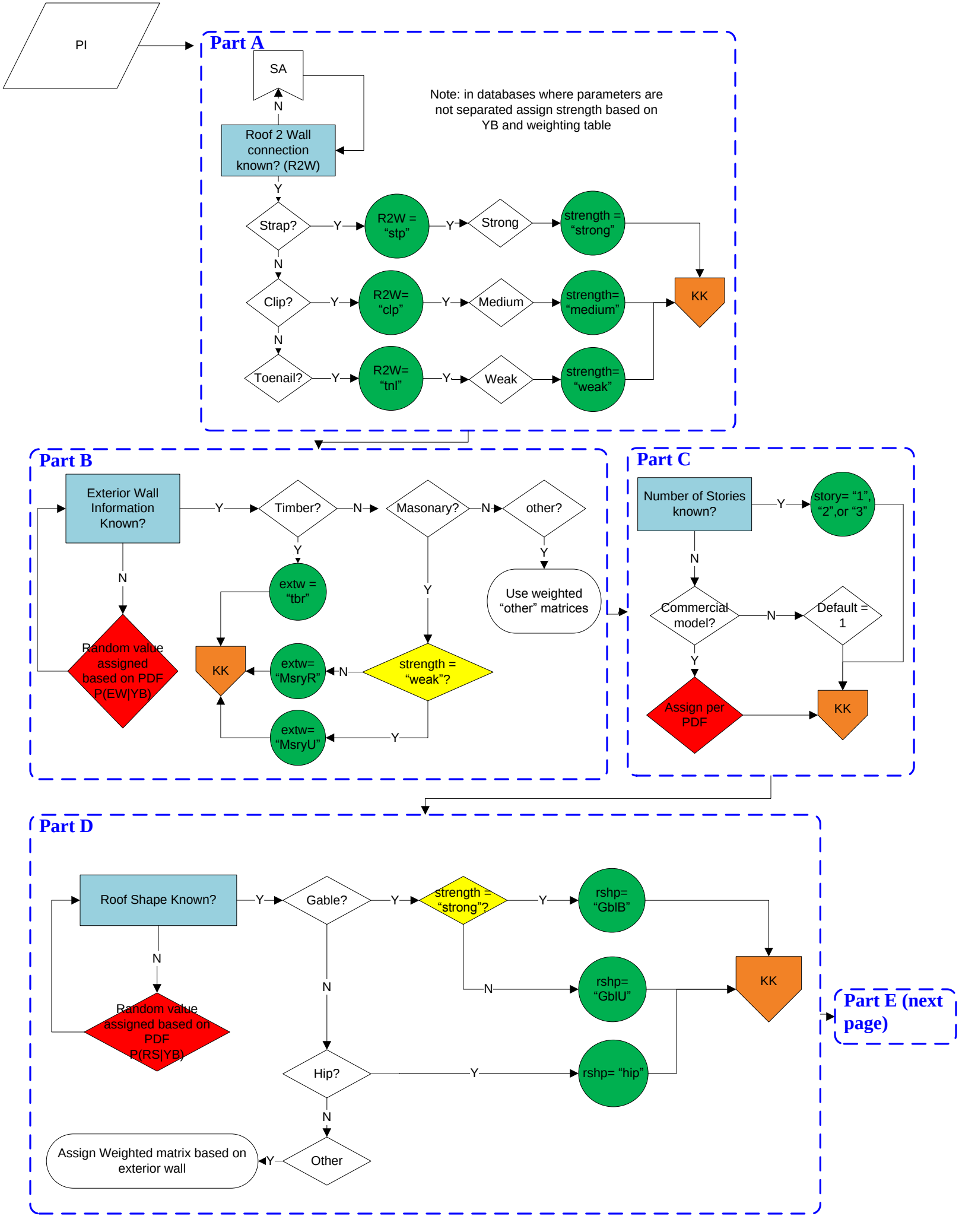
V2.3 (August 2012)

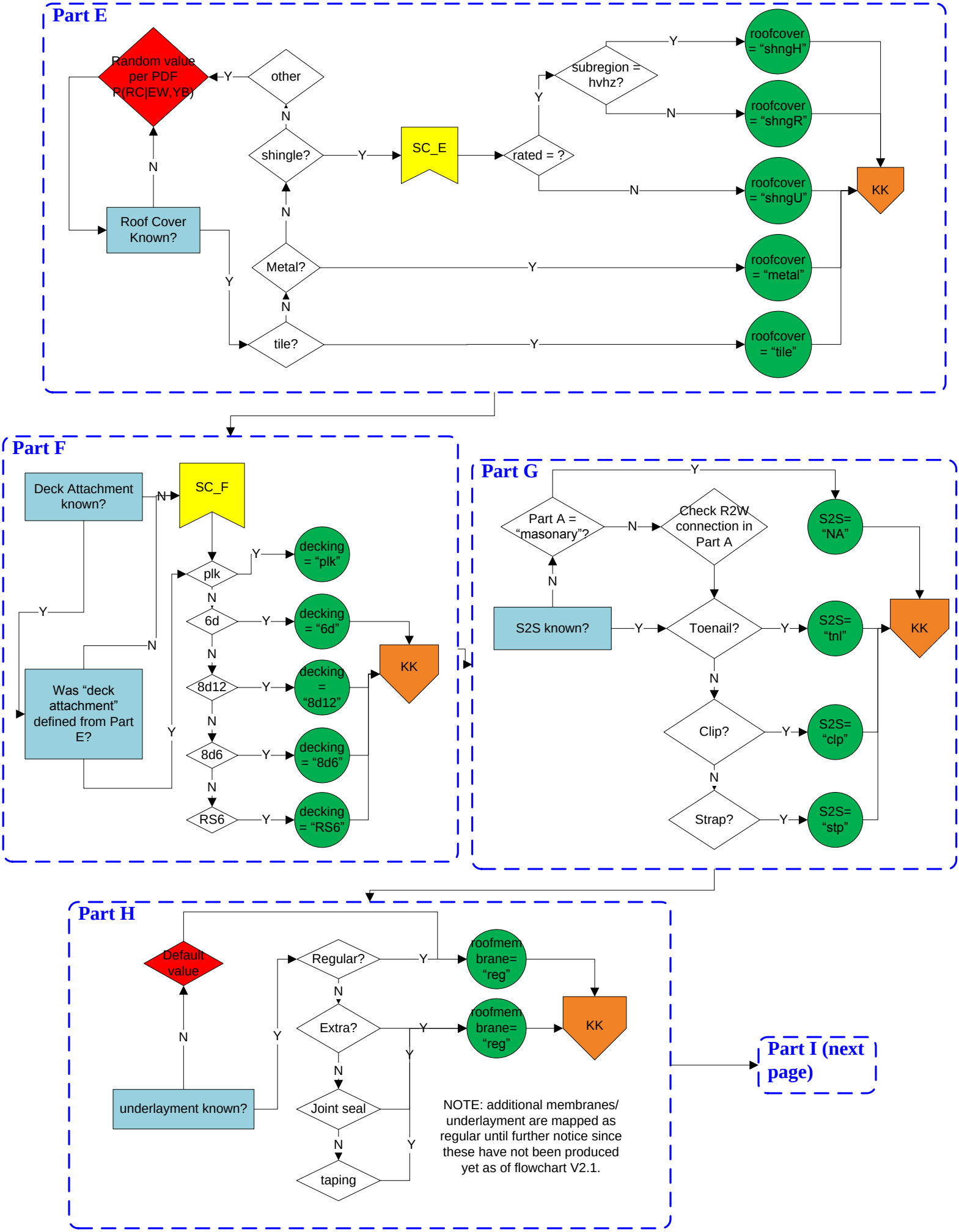
Modifications include:

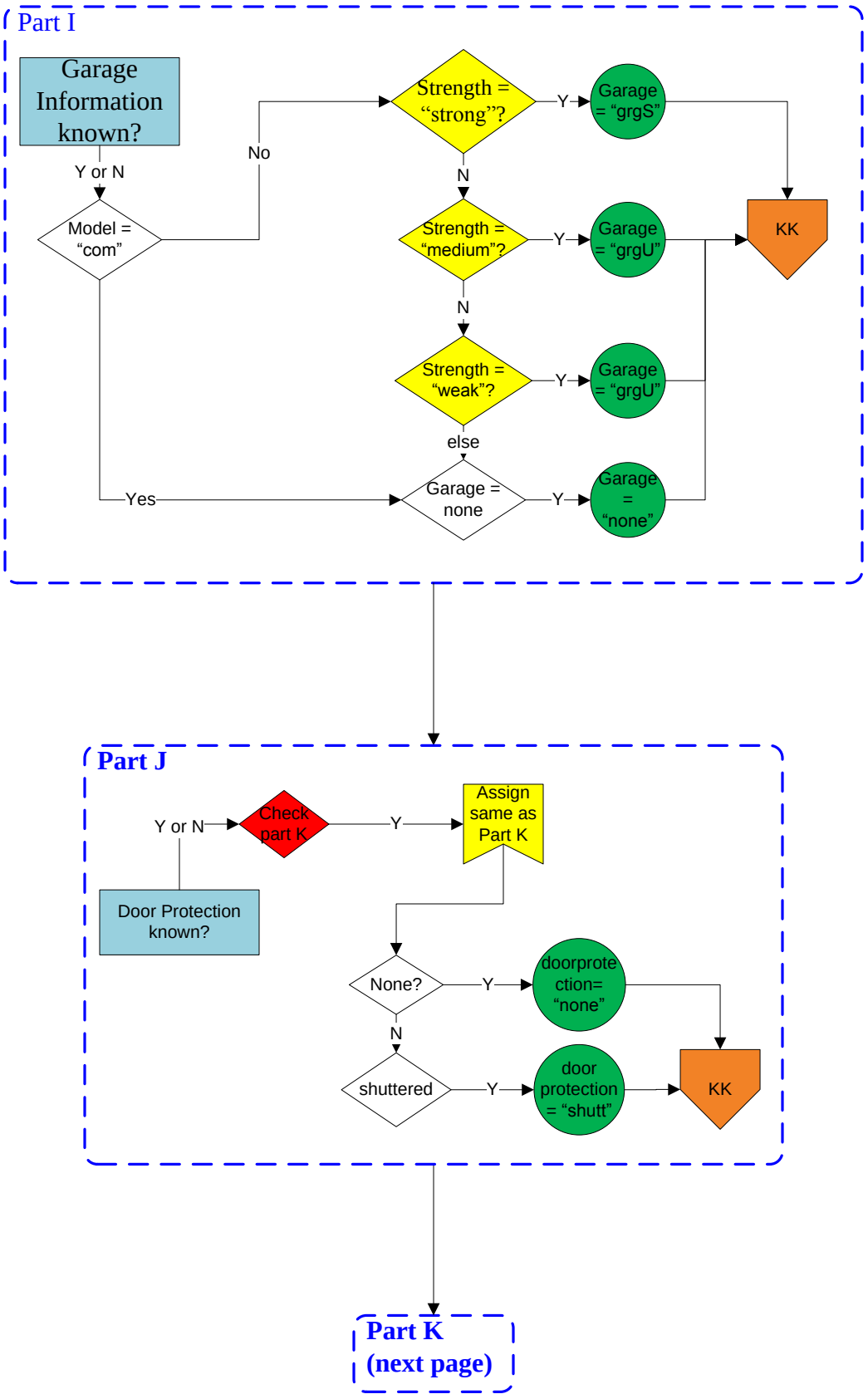
- **Part F** which previously forced all policies through a strength check (SC_F) has been changed to only include cases which have not already gone through the reroofing assignment from **Part E**. This corrects the problem of going through the RR check twice which happened in the case of shingle models.
- In the “Strength Assignment” Tab where the value of “k” is defined an additional parameter lookup is required which forces all cases of metal roofs to have a “k” value of “0" regardless of the building age. This is due to the fact that up until V 2.3 of this flowchart the engineering team does not model “modified” metal roof models for cases of W10 or M10.
- On the Strength Check tab a process was added to Strength Check E (SC_E) which requires that the value for “deck attachment” be saved as it will be used for part F. this is to ensure that the variables are not cleared after a process and that the program does not go through the RR check again.
- For the Strength Check tab for Strength Check F the metal roof cover check has been removed and the value of the deck attachment was defined for all roof cover types in the reroofing check. Should for any reason a deck attachment value not be assigned to a policy a strength check is used to define those cases.

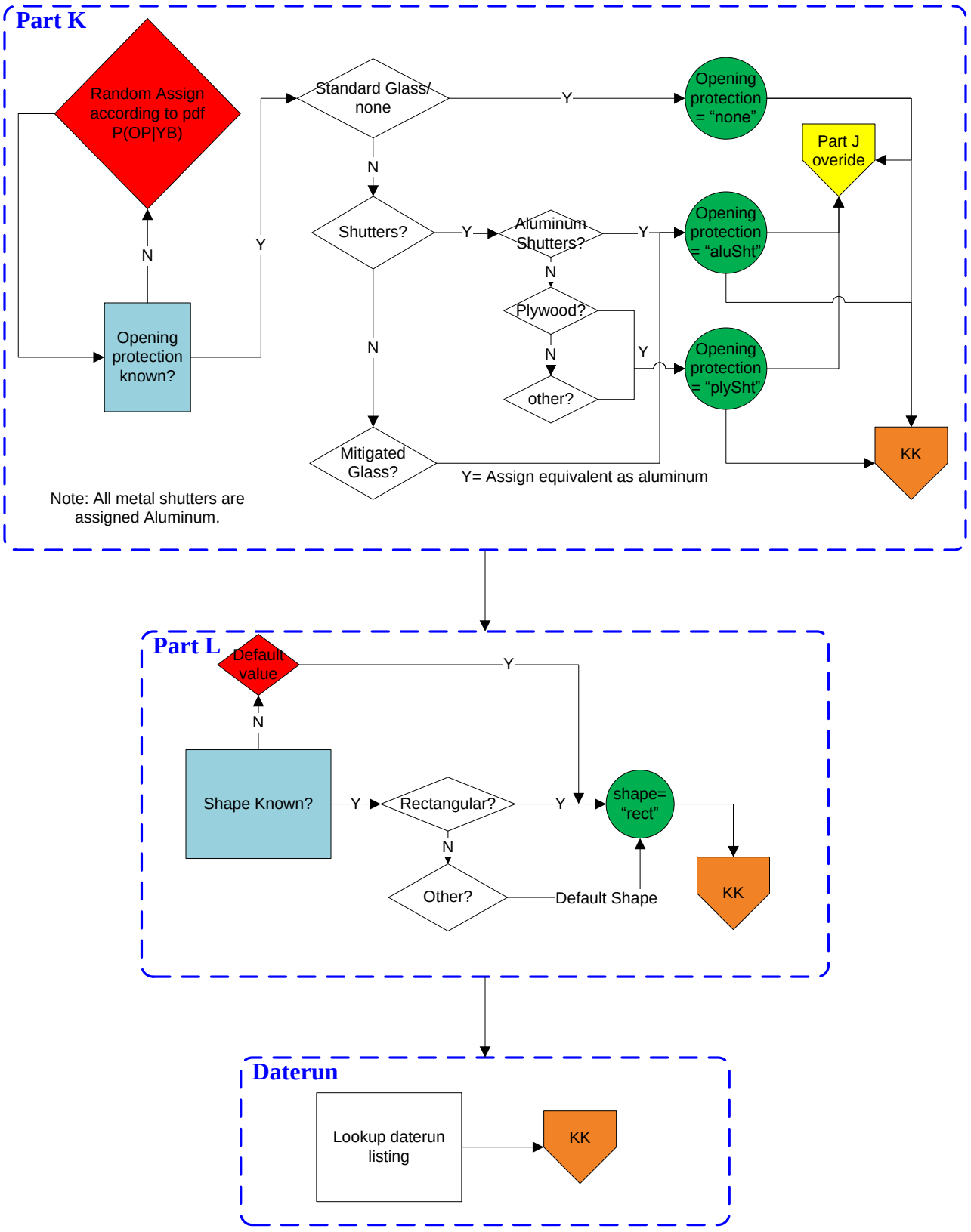

Policy Scan (PS)
START
Scan Policy For List of Parameters With Information Available
N_0=0
Year Built (YB) Available?
N
N=N+1
Y
next
Exterior Wall (EW) Available?
N
N=N+1
Y
next
Number of Stories Available?
N
N=N+1
Y
next
Roof Shape Available?
N
N=N+1
Y
next
Roof Cover Available?
N
N=N+1
Y
next
Door Protection Known?
N
N=N+1
Y
next
Opening Protection Known?
N
N=N+1
next
N value
Sum of All Unknown Parameters For Which statistics are Available
Y
Roof to Wall Connection (R2W) Available?
Y
M_0=0
Stud to sill (S2S) Known?
N
M=M+1
Y
next
Deck Attachment Known?
N
M=M+1
Y
next
Underlayment Known?
N
M=M+1
Y
next
Garage Information Known?
N
M=M+1
Y
next
Shape Known?
N
M=M+1
next
M value
Sum of All Unknown Parameters For Which statistics are Not Available
Choose option (next page)


Preliminary information lookup (PI)
Number of Allowable parameters for which statistics are not known
Number of Allowable parameters for which statistics are known
Option 1
User defined value: Y=_____
User defined value: X=_____
Lookup county
Lookup Exterior wall (EW)
Lookup Year built (YB)
Scan Policy for available parameters
Choose option 1 or option 2
M value
N value
is N+M >= X+Y?
Y
YB available?
N
Assign AGE Weighted matrix
Y
Assign Weighted matrix Based on Weighting Table
Next policy
Option 2
N
Next policy
N
Last policy?
Y
End
User defines the vulnerability type VM1 or VM2
Lookup model to be used (residential or commercial: "res" or "com" respectively)
User defines the damage type; (bldg,int,time,cont…)
Lookup zipcode
Determine region
Determine sub region from wind map
Determine county (for statistics)
Lookup year built
Next
Perform "Part A" on next page
Year built lookup
Era
Insert year built
Year built Known?
Y
Pre 1960?
Y
YB = "____"
N
1960-1970?
Y
YB = "____"
N
1971-1980?
Y
YB = "____"
N
1981-1993?
Y
YB = "____"
N
1994-2001?
Y
YB = "____"
N
2002-present?
Y
YB = "____"
N
Random value assigned based on PDF P(YB| county) or AGE Weighted matrices

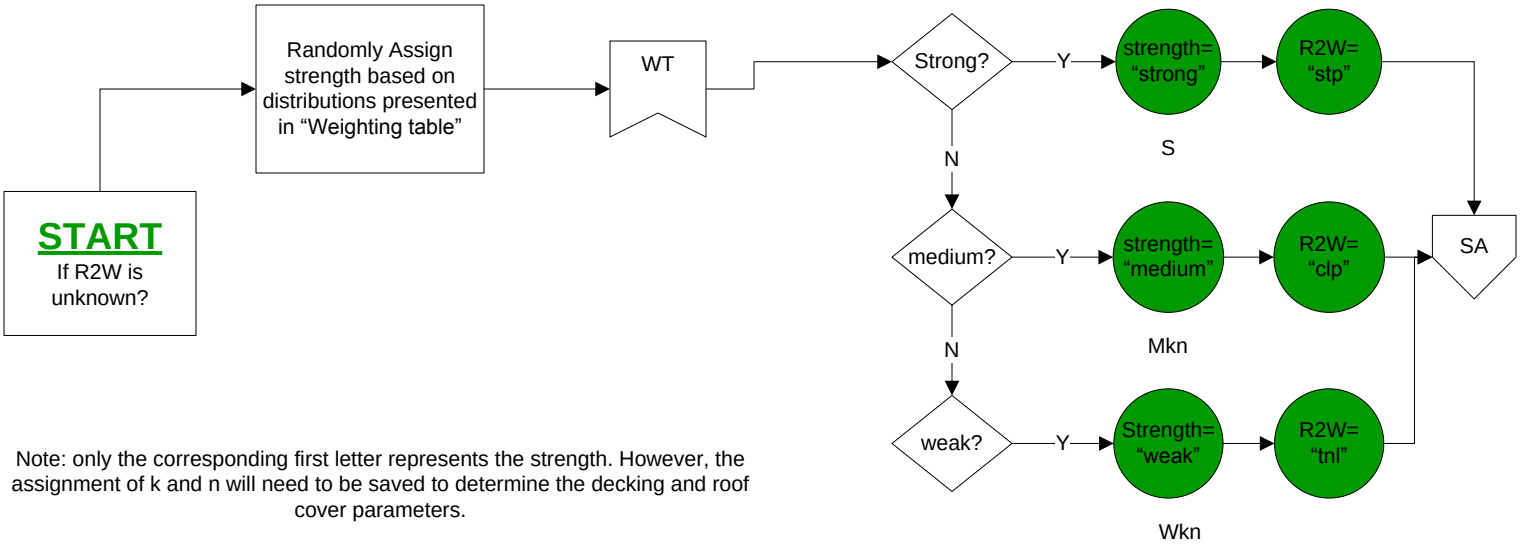

PI
Part A
SA
N
Roof 2 Wall connection known? (R2W)
Y
Note: in databases where parameters are not separated assign strength based on YB and weighting table
Strap?
Y
R2W = "stp"
Y
Strong
strength = "strong"
N
Clip?
Y
R2W= "clp"
Y
Medium
strength= "medium"
KK
N
Toenail?
Y
R2W= "tnl"
Y
Weak
strength= "weak"
Part B
Exterior Wall Information Known?
Y
Timber?
N
Masonary?
N
other?
Y
N
extw = "tbr"
Y
Use weighted "other" matrices
Random value assigned based on PDF P(EW|YB)
KK
extw= "MsryR"
N
strength = "weak"?
extw= "MsryU"
Y
Part C
Number of Stories known?
Y
story= "1", "2",or "3"
N
Commercial model?
N
Default = 1
Y
Assign per PDF
KK
Part D
Roof Shape Known?
Y
Gable?
Y
strength = "strong"?
Y
rshp= "GblB"
N
Random value assigned based on PDF P(RS|YB)
N
rshp= "GblU"
KK
Hip?
Y
rshp= "hip"
N
Assign Weighted matrix based on exterior wall
Y
Other
Part E (next page)


Part E
Random value per PDF P(RC|EW,YB)
other
shingle?
SC_E
rated = ?
subregion = hvhz?
roofcover = “shngH”
roofcover = “shngR”
roofcover = “shngU”
KK
Roof Cover Known?
Metal?
roofcover = “metal”
tile?
roofcover = “tile”
Part F
Deck Attachment known?
SC_F
plk
decking = “plk”
6d
decking = “6d”
8d12
decking = “8d12”
8d6
decking = “8d6”
RS6
decking = “RS6”
KK
Was “deck attachment” defined from Part E?
Part G
Part A = “masonary”?
Check R2W connection in Part A
S2S= “NA”
S2S known?
Toenail?
S2S= “tnl”
KK
Clip?
S2S= “clp”
Strap?
S2S= “stp”
Part H
Default value
Regular?
roofmembrane= “reg”
Extra?
roofmembrane= “reg”
KK
underlayment known?
Joint seal
taping
NOTE: additional membranes/ underlayment are mapped as regular until further notice since these have not been produced yet as of flowchart V2.1.
Part I (next page)


Part I
Garage Information known?
Y or N
Model = "com"
No
Strength = "strong"?
Y
Garage = "grgS"
N
Strength = "medium"?
Y
Garage = "grgU"
N
Strength = "weak"?
Y
Garage = "grgU"
else
Garage = none
Y
Garage = "none"
Yes
KK
Part J
Y or N
Check part K
Y
Assign same as Part K
Door Protection known?
None?
Y
doorprotection= "none"
N
shuttered
Y
door protection = "shutt"
KK
Part K (next page)

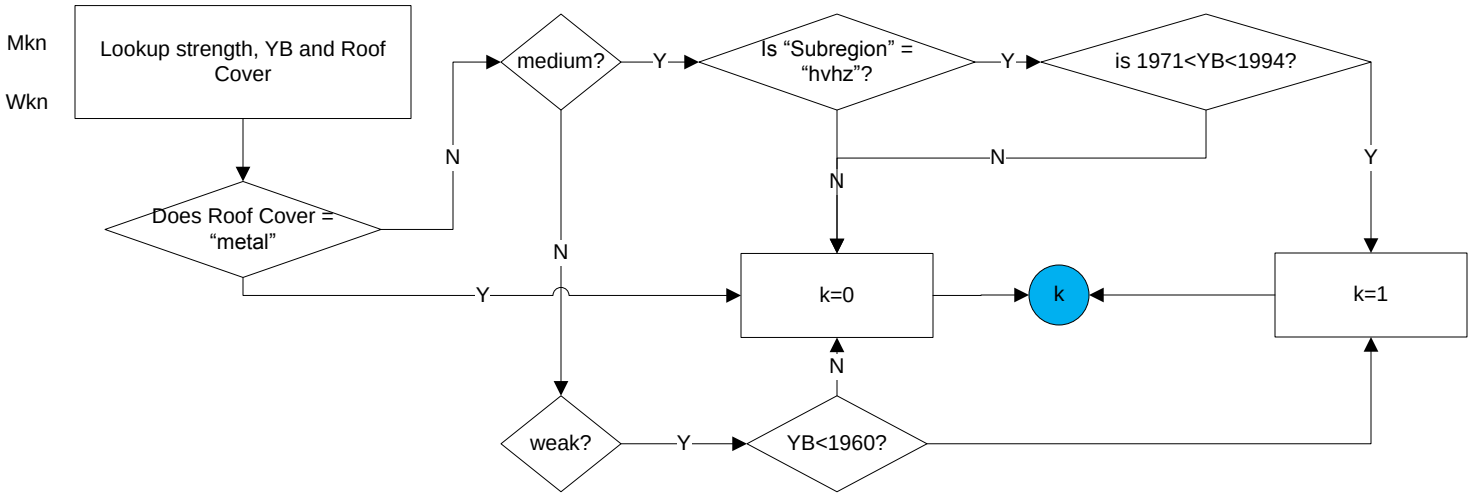

Part K
Random Assign according to pdf P(OP|YB)
Standard Glass/ none
Y
Opening protection = “none”
Part J overide
N
Shutters?
Y
Aluminum Shutters?
Y
Opening protection = “aluSht”
N
Plywood?
N
Y
Opening protection = “plySht”
other?
Y
N
Opening protection known?
N
Y
Mitigated Glass?
Y= Assign equivalent as aluminum
KK
Note: All metal shutters are assigned Aluminum.
Part L
Default value
Y
N
Shape Known?
Y
Rectangular?
Y
shape= “rect”
N
Other?
Default Shape
KK
Daterun
Lookup daterun listing
KK

Strength Assignment (SA)



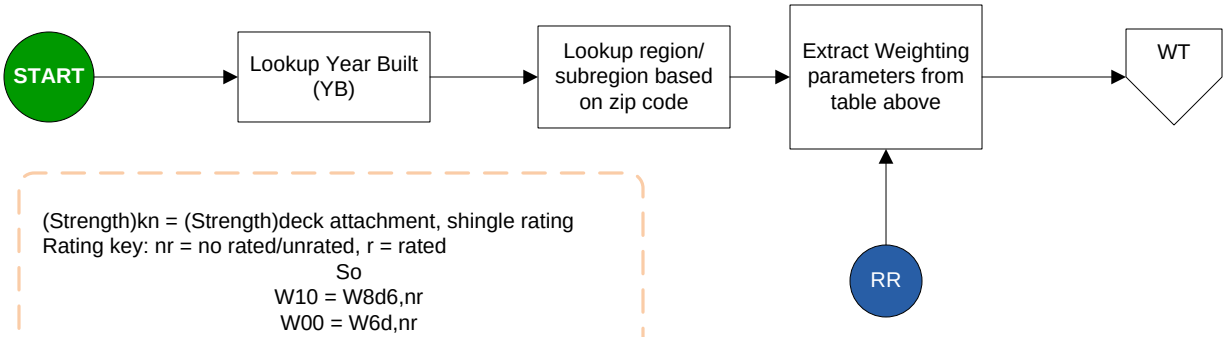
Note: only the corresponding first letter represents the strength. However, the assignment of k and n will need to be saved to determine the decking and roof cover parameters.

Define k value (weak and medium models)



Weighting Table

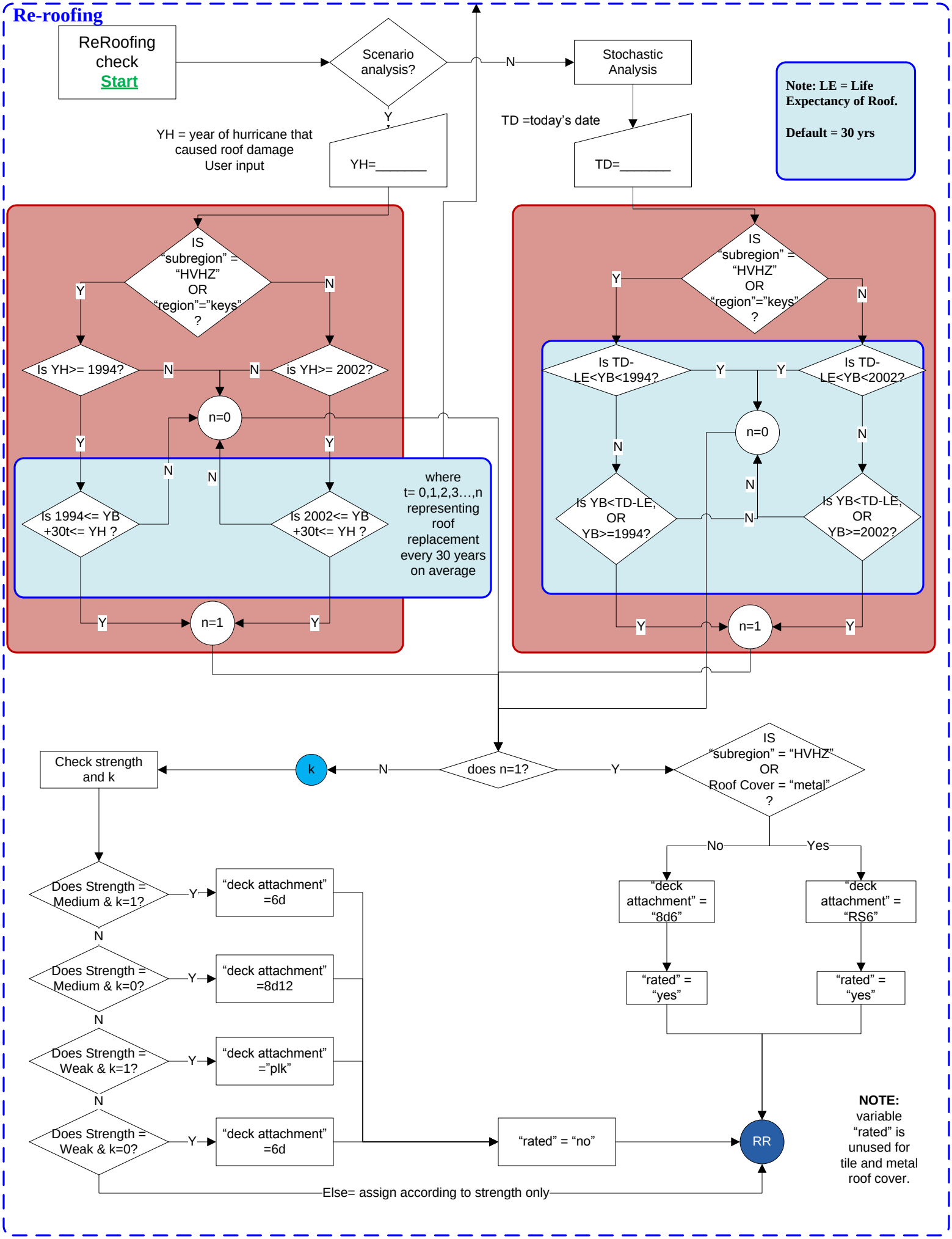
	Pre-1960	1960-1970	1971-1980	1981-1993	1994-2001	2002-pres.
HVHZ	2/3 W 1n 1/3 M 00	2/3 W 0n 1/3M 0n	1/2W 0n 1/2M 1n	2/3 W 0n 1/3 M 1n	S01	S01
Keys	? W 1n ? M 0n	M 0n	M 0n	M 0n	1/3 M 0n, 2/3(S00 or S02)	S00 or S02
WBDR	W 1n	2/3W 0n 1/3M 0n	1/3 W 0n, 2/3 M 0n	1/3 W 0n 2/3 M 00	? M 0n ? (S00 or S02)	S00 or S02
Inland	W 1n	2/3W 0n 1/3M 0n	½ W 0n, ? M 0n	½ W 0n ? M 0n	? M 0n, ? (S00 or S02)	S00 or S02

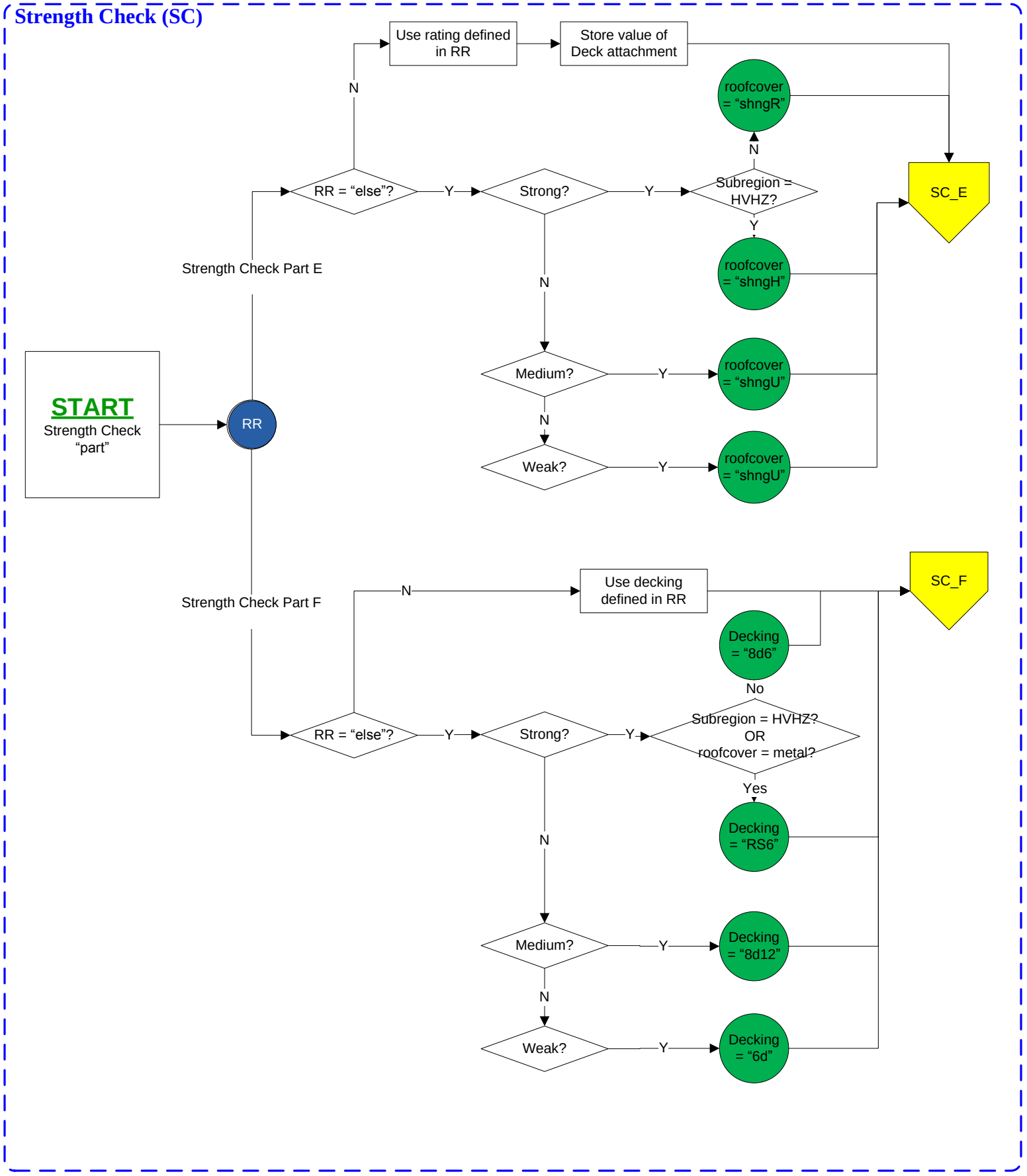


(Strength)kn = (Strength)deck attachment, shingle rating
Rating key: nr = no rated/unrated, r = rated
So
W10 = W8d6,nr
W00 = W6d,nr
W01 =W11= W8d6,r
M10 = M6d,nr
M00= M8d12,nr
M01 =M11= M8d6,r
S00 = S 8d6, r
S01 = S RS6, HVHZ rated double straps
S02 = S RS6, metal roof, single straps

Reroofing (RR) determines the value of n for the table above. This value corresponds to roof replacement which will change the parameters for "roof cover" and deck attachment"

NOTE: Weighting Table has two purposes:
For option 1: Combine and weight matrices based on Era.
For option 2: assigns a strength randomly, so for example, pre 1960 in HVHZ with ½ W and ½ M, there is a 50% chance of assigning either weak or medium.


Re-roofing
ReRoofing check
Start
Scenario analysis?
N
Stochastic Analysis
Y
YH = year of hurricane that caused roof damage
User input
YH=_____
TD =today's date
TD=_____
Note: LE = Life Expectancy of Roof.
Default = 30 yrs
IS "subregion" = "HVHZ" OR "region"="keys" ?
Y
N
Is YH>= 1994?
is YH>= 2002?
n=0
Is 1994<= YB +30t<= YH ?
Is 2002<= YB +30t<= YH ?
where t= 0,1,2,3…,n representing roof replacement every 30 years on average
n=1
IS "subregion" = "HVHZ" OR "region"="keys" ?
Is TD-LE<YB<1994?
Is TD-LE<YB<2002?
n=0
Is YB<TD-LE, OR YB>=1994?
Is YB<TD-LE, OR YB>=2002?
n=1
does n=1?
k
Check strength and k
IS "subregion" = "HVHZ" OR Roof Cover = "metal" ?
No
Yes
Does Strength = Medium & k=1?
"deck attachment" =6d
Does Strength = Medium & k=0?
"deck attachment" =8d12
Does Strength = Weak & k=1?
"deck attachment" ="plk"
Does Strength = Weak & k=0?
"deck attachment" =6d
"deck attachment" = "8d6"
"deck attachment" = "RS6"
"rated" = "yes"
"rated" = "yes"
"rated" = "no"
RR
Else= assign according to strength only
NOTE: variable "rated" is unused for tile and metal roof cover.


Strength Check (SC)
START
Strength Check "part"
RR
Strength Check Part E
RR = "else"?
Y
N
Use rating defined in RR
Store value of Deck attachment
Strong?
Y
N
Subregion = HVHZ?
Y
N
roofcover = "shngR"
roofcover = "shngH"
SC_E
Medium?
Y
N
roofcover = "shngU"
Weak?
Y
roofcover = "shngU"
Strength Check Part F
RR = "else"?
Y
N
Use decking defined in RR
SC_F
Strong?
Y
N
Subregion = HVHZ? OR roofcover = metal?
Yes
No
Decking = "8d6"
Decking = "RS6"
Medium?
Y
N
Decking = "8d12"
Weak?
Y
Decking = "6d"