Nebraska DOT BrM Configuration

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NEBRASKA

Good Life. Great Journey.

DEPARTMENT OF TRANSPORTATION

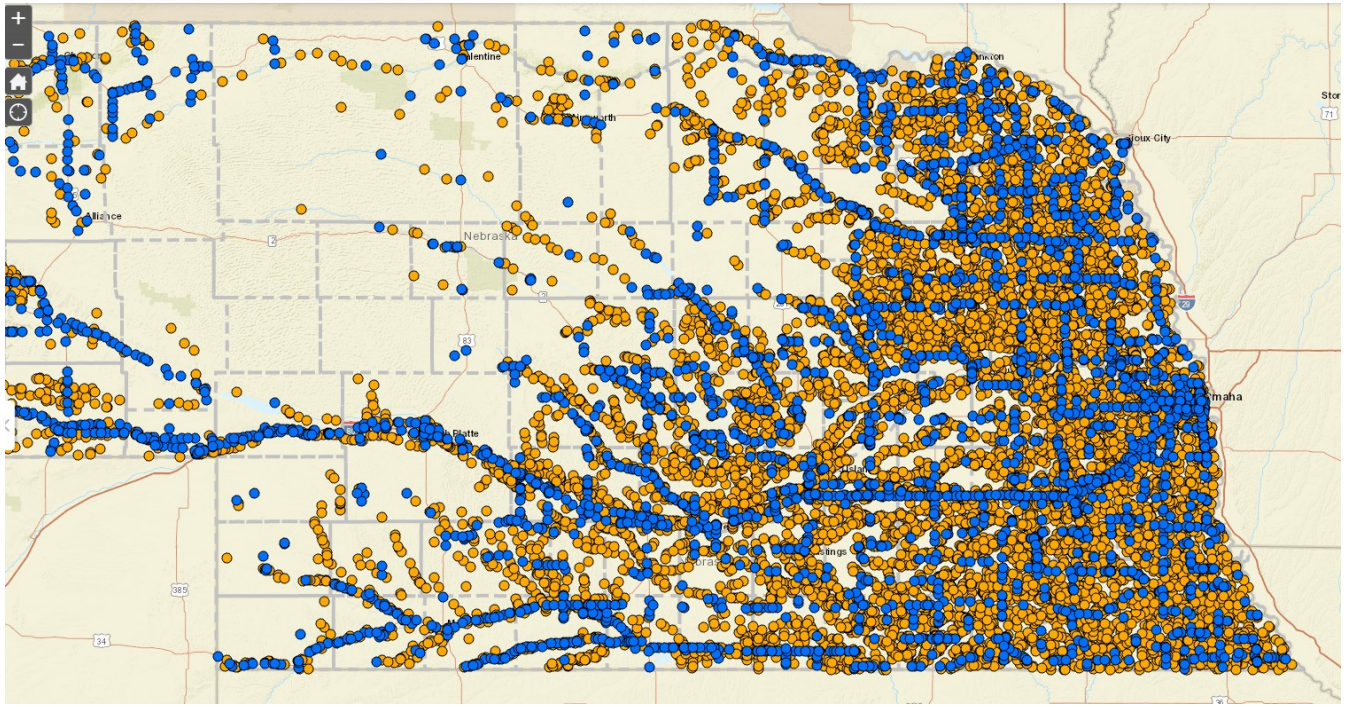
BrM Configuration and Training Service Unit Project

- Currently NDOT uses BrM for Inspection only and data analysis and reporting is done with other methods.
  - This project is an attempt to make the processes for long-range funding and major work program optimization better supported and easier to run for future bridge managers.
- Goals for this project:

1. Configure BrM to provide a forecast of network condition at various funding levels.
2. Configure BrM to provide a bridge construction program for major work (deck replacement, or entire superstructure replacement or bridge replacement).

- Status – Just getting started but moving right along!

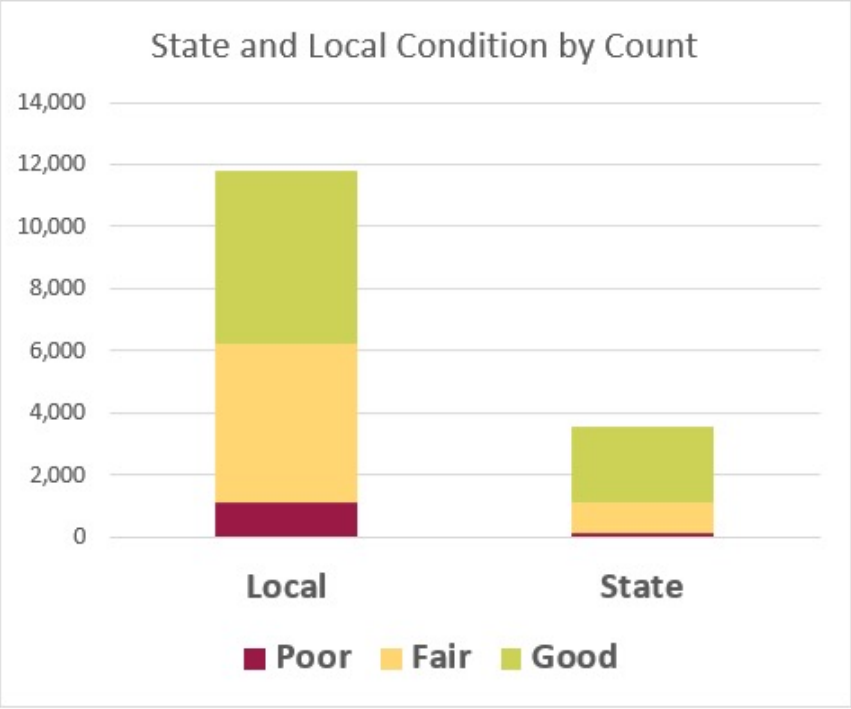
BrM and Bridge Inspection in Nebraska

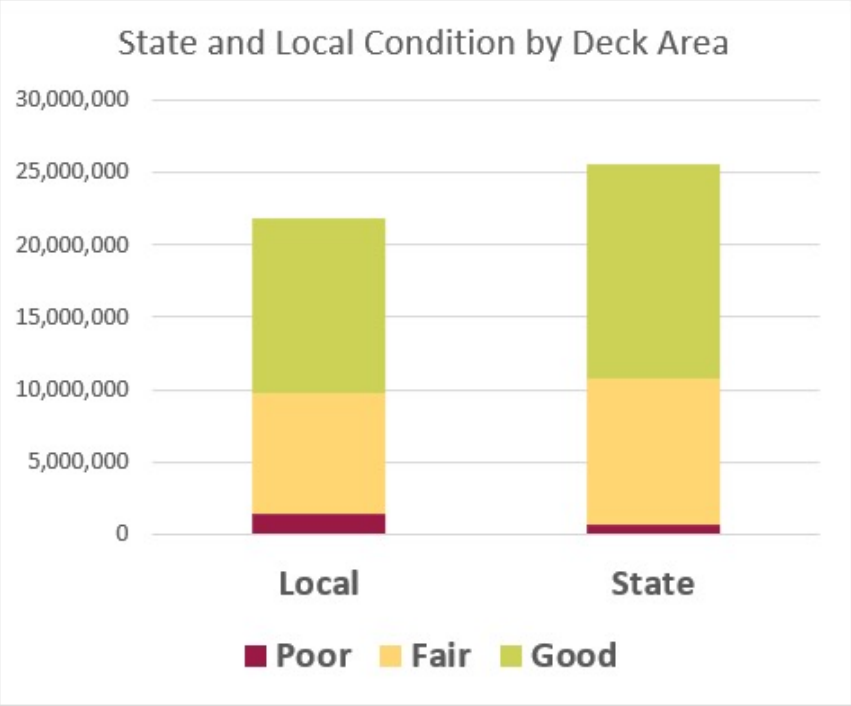


BrM and Bridge Inspection in Nebraska

- Enterprise installation of version 6.4
  - Approximately 380 active BrM users
  - 112 Local agencies manage inspections and construction on their bridges
    - 11,500+ structures on Local system
    - Element inspection is required only on NHS (58 structures)
    - All local system structures have maximum 24-month inspection frequency
  - 2 State system inspection teams
    - 3,500+ structures on State system
    - Element inspection is required on State System
    - Most structures on a 24 month inspect cycle but about 580 meet requirements for a 48-month inspection frequency

BrM and Bridge Inventory in Nebraska

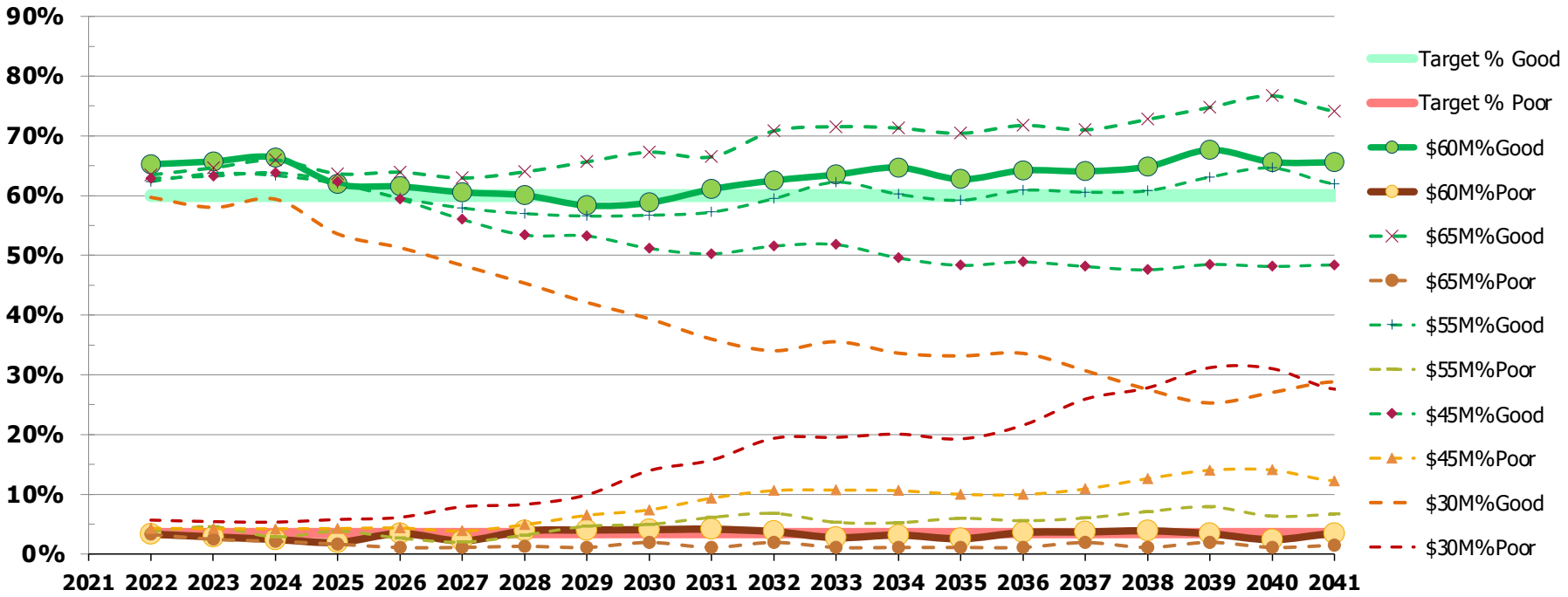




Bridge Management – Program Funding Level

- Nebraska Statute requires a 20 Year Study of Transportation Needs and funding levels
  - LB 39-1365.02 and LB 39-1365.01
- This is an estimate of average annual funding to achieve performance targets for State system bridges.
  - used by the State Legislature for appropriations decisions
- It is also used by NDOT to approximate allocation balance between major work versus repair strategies at a systemic level
- Goal is to find minimum funding to achieve performance targets

Bridge Management – Program Funding Level



Bridge Management – Major Work vs Other Work

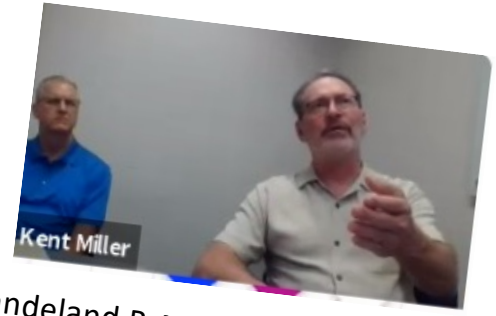
- Automated preliminary data review provides suggested strategy
  - NBI data is screened by decision tree when data is updated from an SQL database
  - Any structure that is not a Repair or Preservation Candidate is reviewed for more major work.
  - Repair and preservation candidates are only reviewed when they are in the limits of a proposed roadway project.
- For major work Bridge Management Engineering review confirms strategy. Yearly recommendations are made for programming bridges that need:
  - Replacements
  - Rehab (replacing superstructure)
  - Re-deck (superstructure repairs only)
- Finalized strategies for both Major work and Preservation strategies are published to OnBase, a construction project document management and review workflow platform
- Cost estimates are done using AASHTOWare Project

BrM Configuration Process – Getting Started

1. Applied for State Planning and Research (SPR) funding for a new activity: **Bridge Management and Load Rating**
   - Received funding for
     - BrM Annual License
     - BrR Annual License
     - Consultant License (for BrR)
     - Service Units – 8
     - Consultant service cost

2. Contacted Mayvue and developed options for a service unit project
   - Another option would have been to go with the Set-up Configuration and Training that is available in the AASHTOWare Catalog.

BrM Configuration and Training – Getting the right people in the room

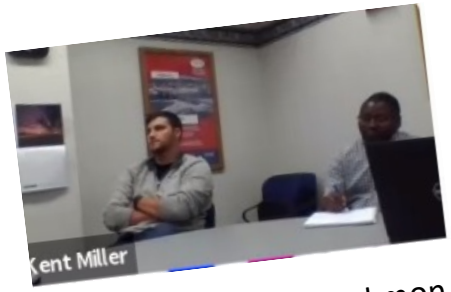


Jeff Handeland BrM Manager

Me

and much more

Eric Bird -Bridge Data Tech



Kpandji Lakmon - Load Rating Engineer

Others from NDOT Attending Remotely

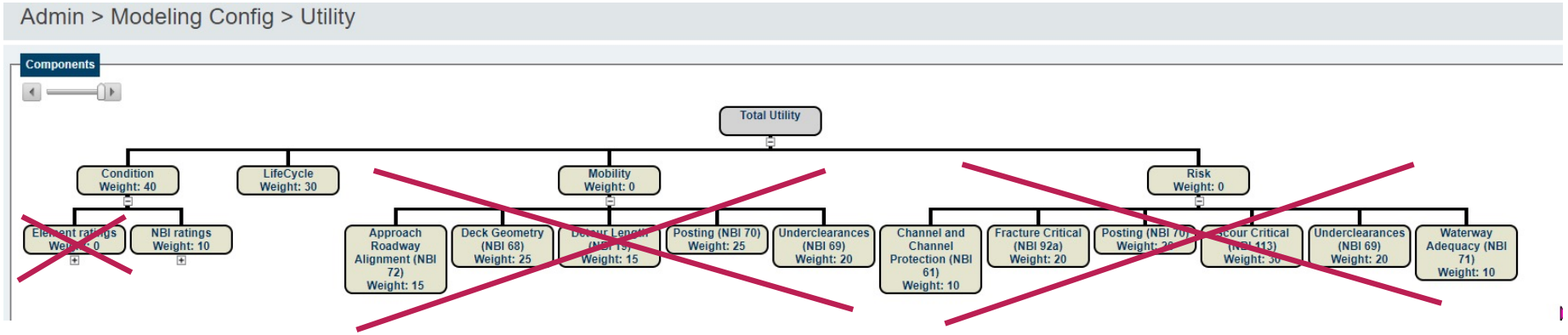
Babrak Niazi - NE Bridge Inspection Program Engineer

Fouad Jaber - Bridge Research Engineer

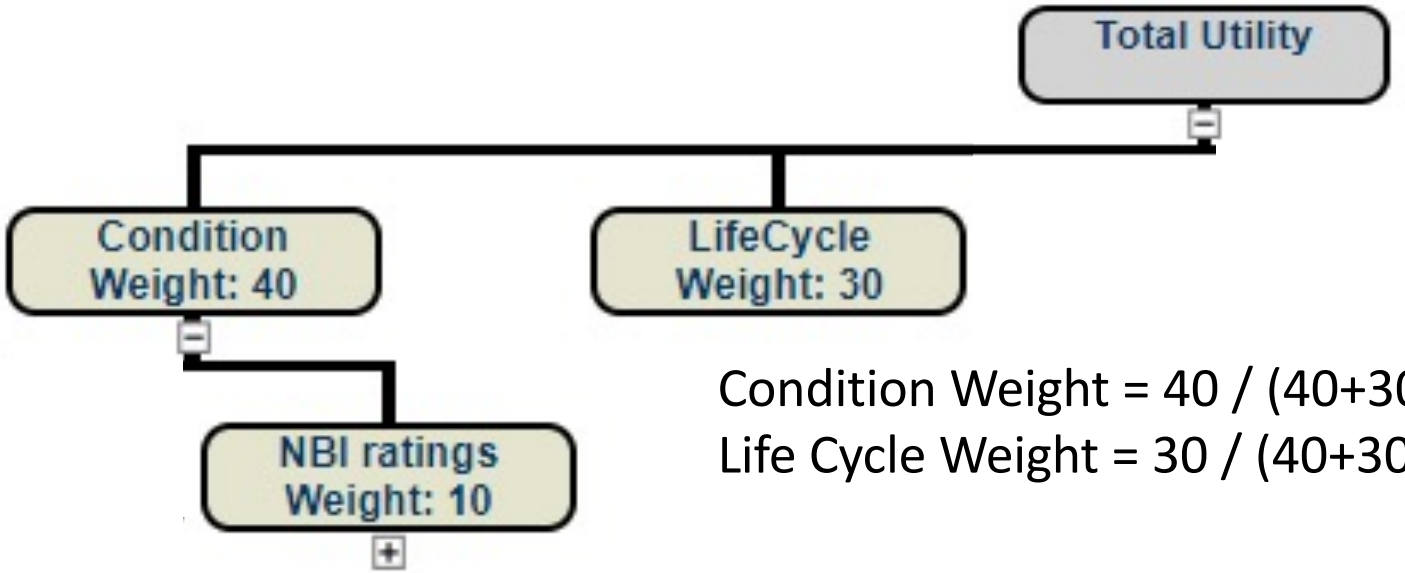
Mike Vigil - Bridge Management Engineer

Mark Traynowicz - State Bridge Engineer

Utility – Initial Configuration for Network Condition Forecast

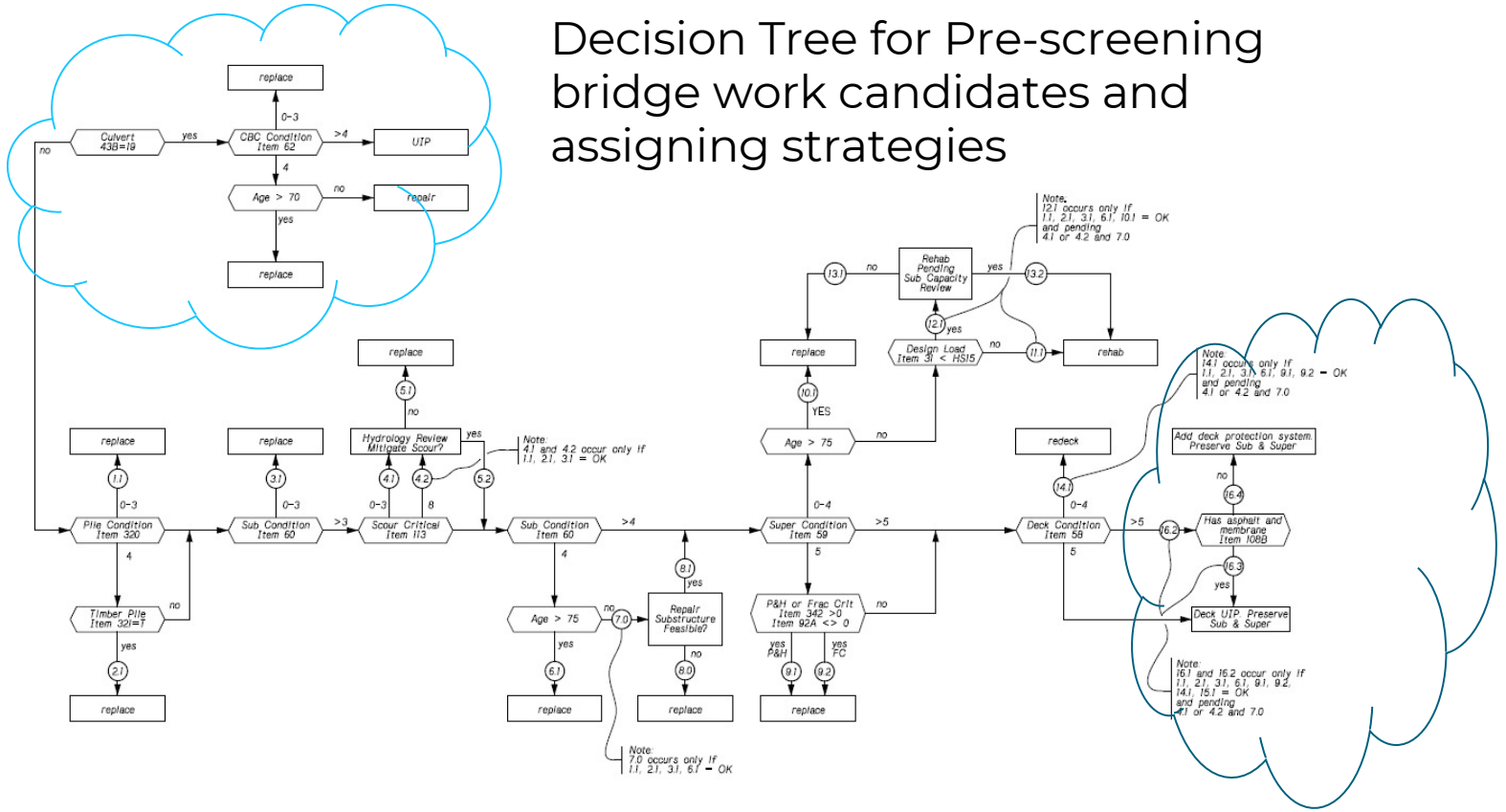


Utility – Initial Configuration



Condition Weight = 40 / (40+30) = 57
Life Cycle Weight = 30 / (40+30) = 43

Decision Tree for Pre-screening bridge work candidates and assigning strategies



Simplified Decision Tree Rules – Major Work

- Replace Bridge
  - Sub < 4
  - or (Sub = 4 and Age > 75)
  - or [Sub > 4 and Super = 5 and (Super has Pin and Hanger or is Fracture Critical)]
  - or (Super < 5 and Age > 75)
- Replace Culvert
  - Condition < 4
  - or (Condition = 4 and Age ≥ 70)

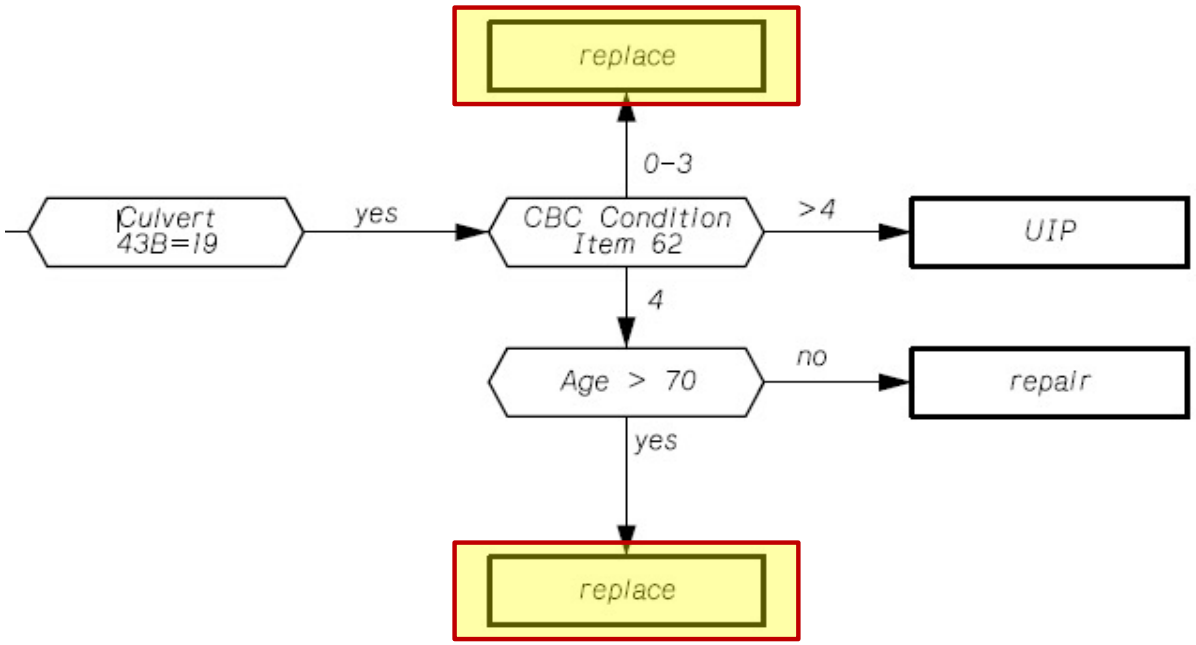
Simplified Decision Tree Rules – Major Work

- Rehab Bridge (replace entire superstructure)
  - Sub > 4
  - and Super < 5
  - and Age < 75
  - and Design Load HS 15 or greater
- Re-deck Bridge
  - Sub > 4
  - and [(Super = 5 and has no Pin and Hanger and is not Fracture Critical) or Super > 5]
  - and Deck < 5

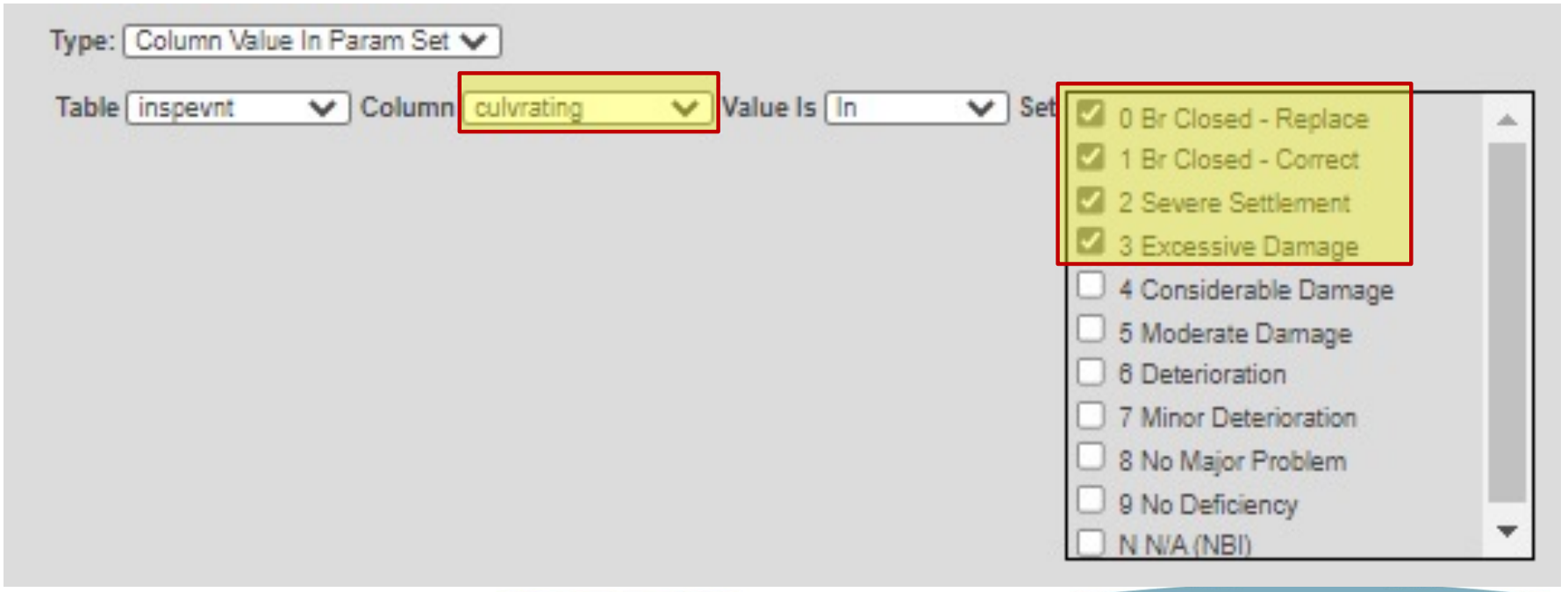
Simplified Decision Tree Rules - Repairs

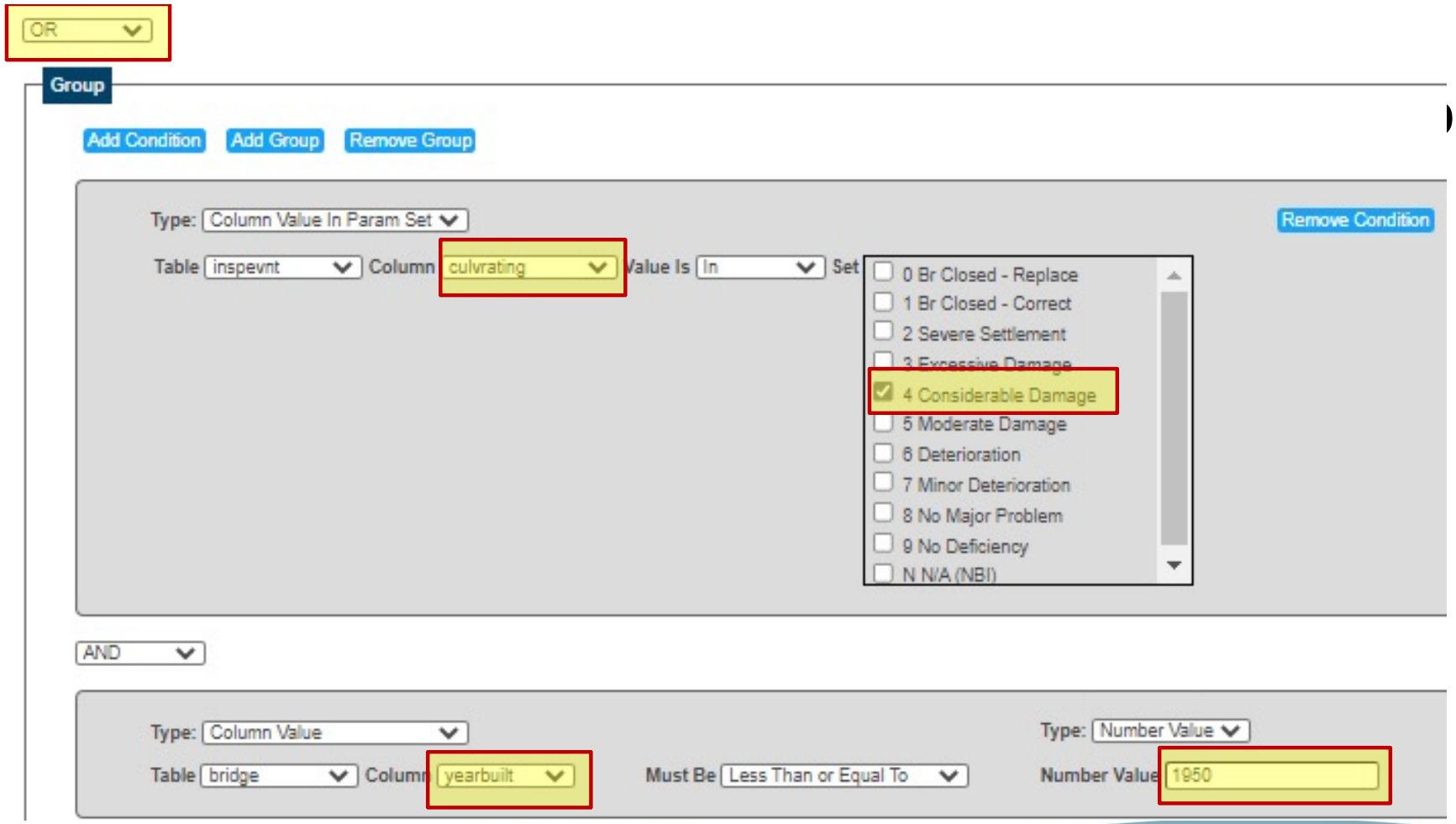
- Any structure that is not a major work candidate is a Repair candidate
  - Work is done and designed for the frequency of paving projects – assumed average of 12 years
- Bridge repair strategies
  - If Asphalt and Waterproofing Membrane is not present
    - Deck repairs (quantity scaled as deck condition decreases)
    - Place Asphalt and Waterproofing Membrane
    - Bridge is moved on to a slower deterioration model
  - If Asphalt and Waterproofing Membrane is present
    - Remove and replace Asphalt and waterproofing membrane
  - Substructure and Superstructure repairs (quantity scaled as condition decreases)
  - Joints are replaced

Decision Tree Example for Culverts



Admin > Modeling Config > Network Policies – Example for Culvert Replacement



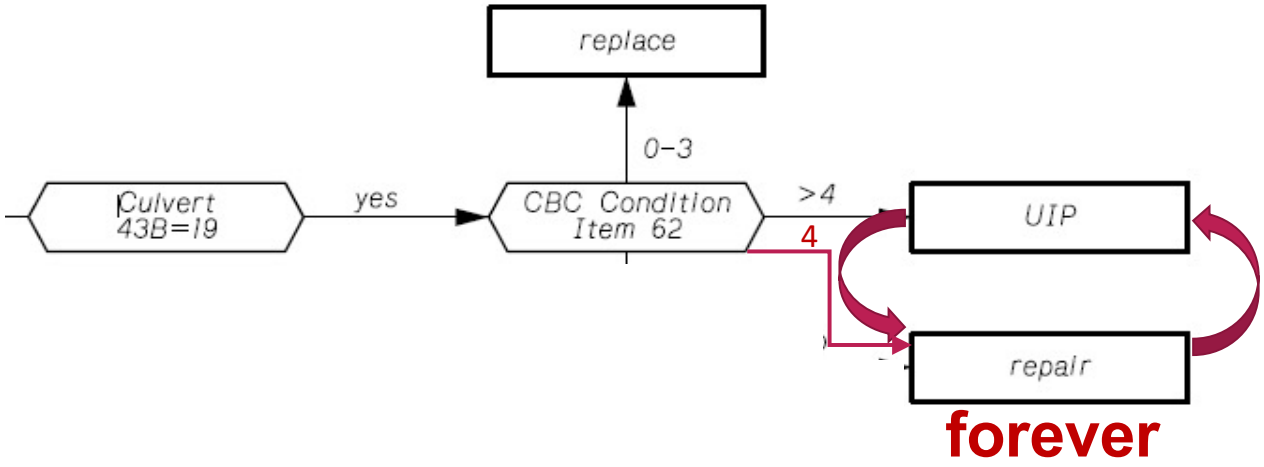

OR
Group
Add Condition
Add Group
Remove Group
Type: Column Value In Param Set
Remove Condition
Table inspevnt
Column culvrating
Value Is In
Set
0 Br Closed - Replace
1 Br Closed - Correct
2 Severe Settlement
3 Excessive Damage
4 Considerable Damage
5 Moderate Damage
6 Deterioration
7 Minor Deterioration
8 No Major Problem
9 No Deficiency
N N/A (NBI)
AND
Type: Column Value
Type: Number Value
Table bridge
Column yearbuilt
Must Be Less Than or Equal To
Number Value 1950

Admin > Modeling Config > Network Policies –Example for Culvert Replacement

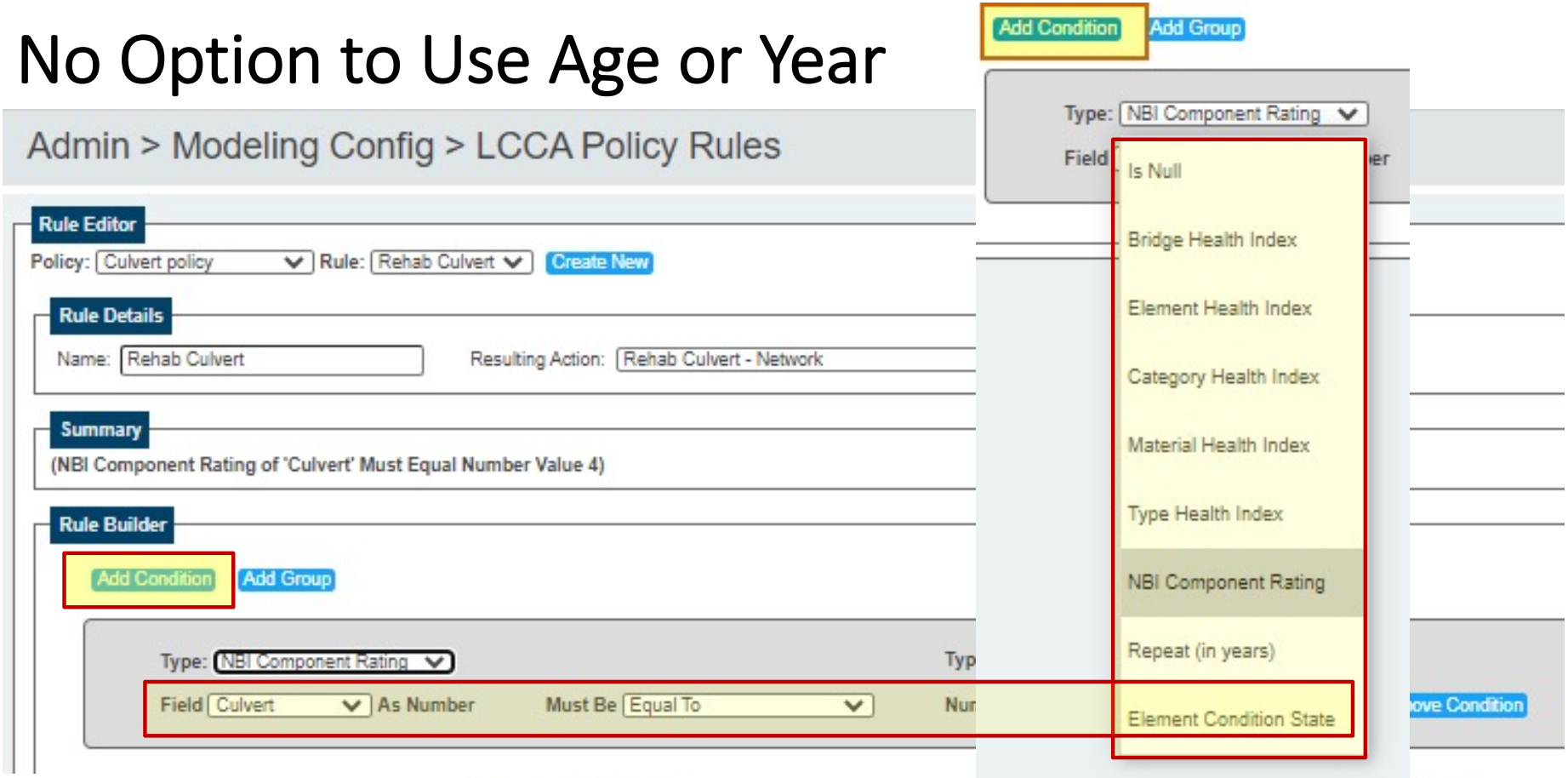
- A parameterized JSON text string is generated

(Column 'culvrating' of Table 'inspevnt' Is In Set
'0 Br Closed – Replace
, 1 Br Closed – Correct
, 2 Severe Settlement
, 3 Excessive Damage'
OR (Column 'culvrating' of Table 'inspevnt' Is In Set
'4 Considerable Damage'
AND Column 'yearbuilt' of Table 'bridge' Must Be Less Than Or Equal To Number Value 1950))

Decision Tree Example for Culverts



No Option to Use Age or Year



Challenges

1. Options for including age and load rating data items (design load) in Network policies and LCC policies
2. The first-year problem – distribution of initial NBI deterioration for slower-than-average deterioration
3. Protection-system sensitive deterioration modelling. The capability to have deterioration models that change in response to placement of protection systems on bridges. NDOT currently puts Deck, Super and Sub onto a slower deterioration model if and epoxy polymer overlay or and asphalt overlay with waterproofing membrane are present

Options

- Workarounds?
- Modify business practices?
- Modify software (enhancement)?
- Use existing method or a new method to meet the forecasting requirement?

- Do other agencies:
  - use age as a criteria to guide strategy selection at the network level?
  - have interest in a variable deterioration rate depending on preservation systems?
  - want to see a smoother performance measure forecast that avoids the first-year problem?

Questions? Comments?

- kent.miller@nebraska.gov

BrM and Bridge Inspection in Nebraska

- Upcoming Inspections Map
- https://dot.nebraska.gov/business-center/bridge/inspection/

- Weight Restricted Bridge Map
- https://gis.ne.gov/portal/apps/webappviewer/index.html?id=f6945569f00a43268462568591475ab8