Chicago Metropolitan Agency for Planning

An Approach to Setting Indicator Targets for the Next Long-Range Plan: Pavement Condition

September 18, 2015

Synopsis

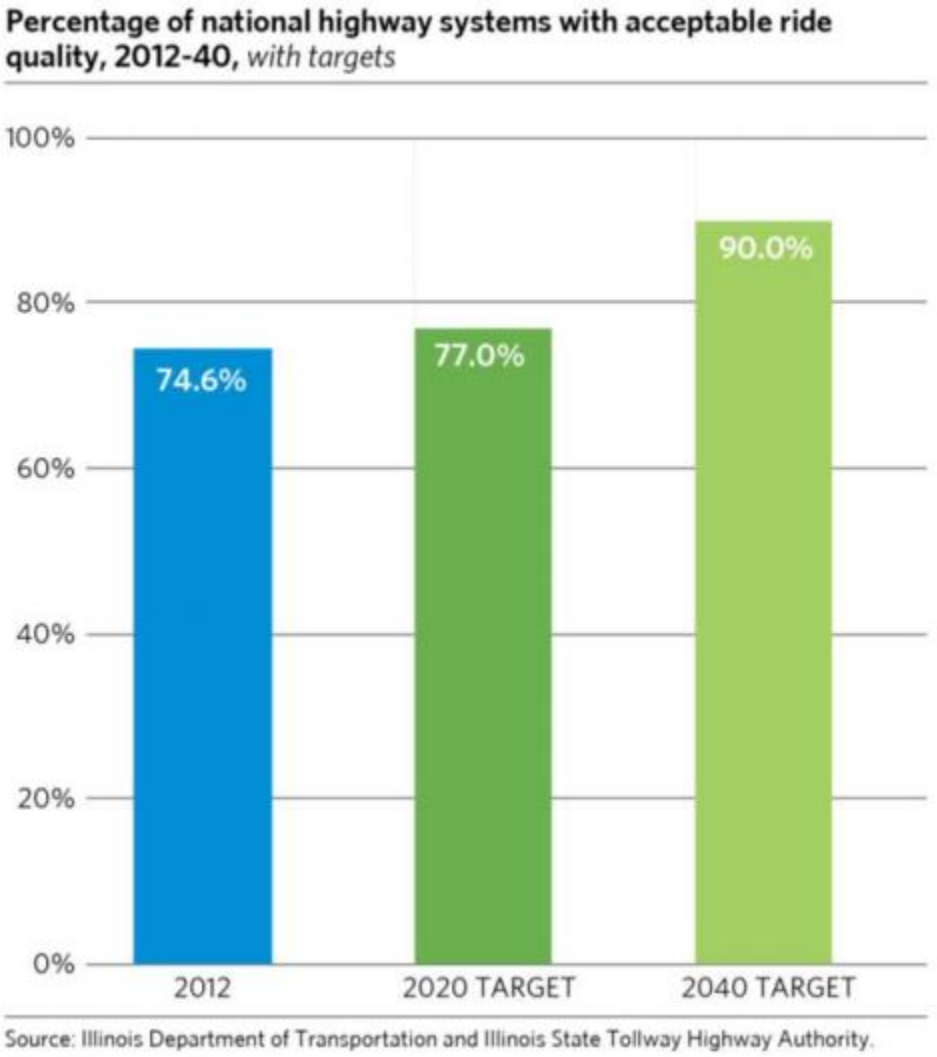
- Measuring performance and setting targets is a major focus of GO TO 2040
- MAP-21 strengthens and modifies this focus
- Staff exploring new ways to set performance targets and connect them to financial needs
- Seeking early review from stakeholders on potential approach for next plan for pavement condition: HERS-ST model and assumptions

Background: GO TO 2040 transportation indicators

1. Percentage of National Highway System (NHS) with acceptable ride quality
2. Percentage of bridges in “structurally deficient” condition
3. Percentage of transit assets in a state of good repair
4. Average congested hours of weekday travel for limited access highways

Background: GO TO 2040 pavement target

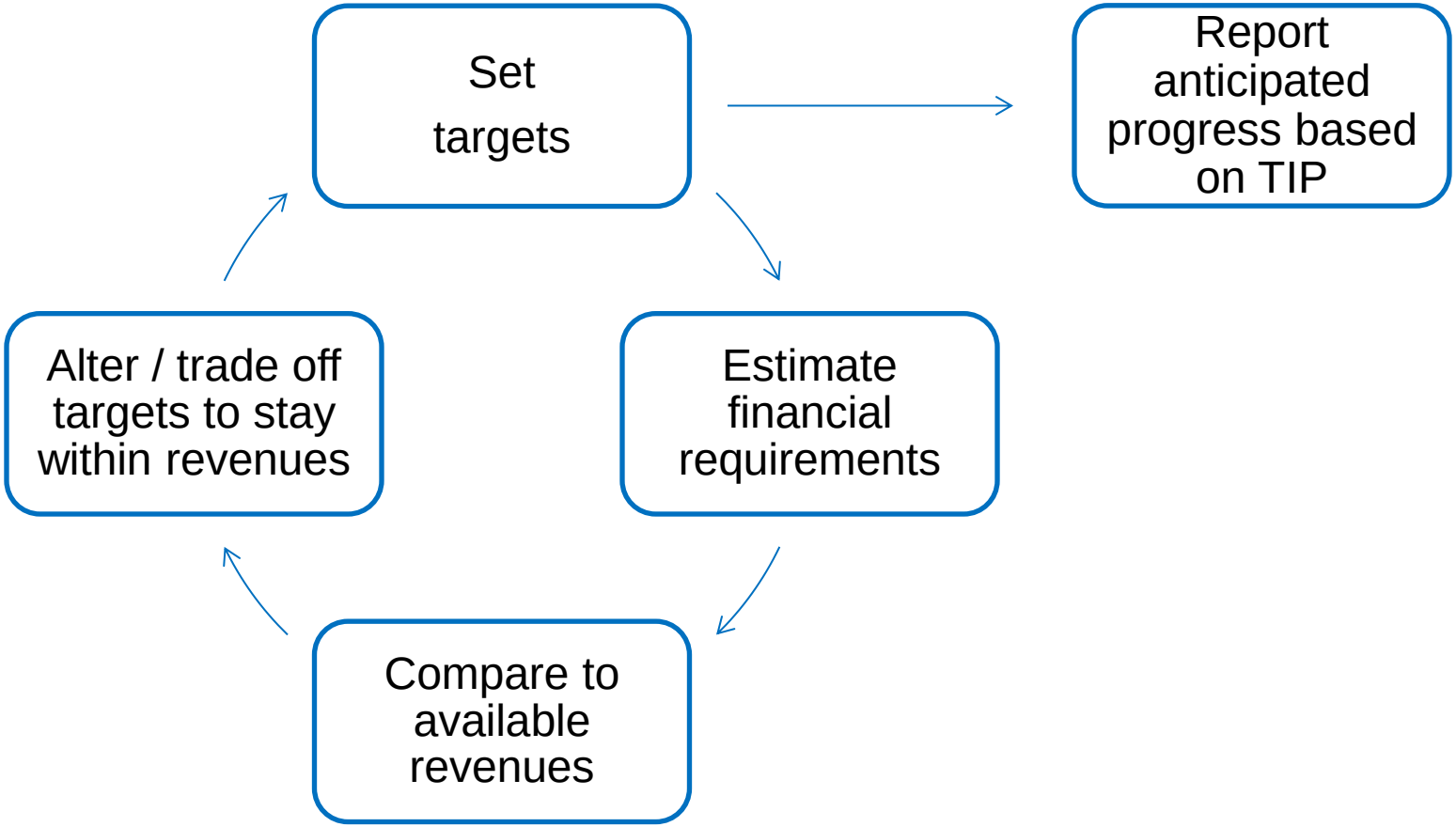
- 90% of NHS centerline miles in acceptable condition by 2040
  - International Roughness Index (IRI) ≤ 170.
  - IRI is cumulative deviation from a smooth surface in inches per mile.



Drivers of change

- Concerns heard in GO TO 2040 update
  - Maintenance needs should be determined by condition, not assumed capital replacement intervals
  - Achieving indicator targets should be tied to planned expenditures
- MAP-21
  - Transportation Improvement Program should document anticipated progress toward targets
  - Some additional indicators required

Potential approach for next plan/program



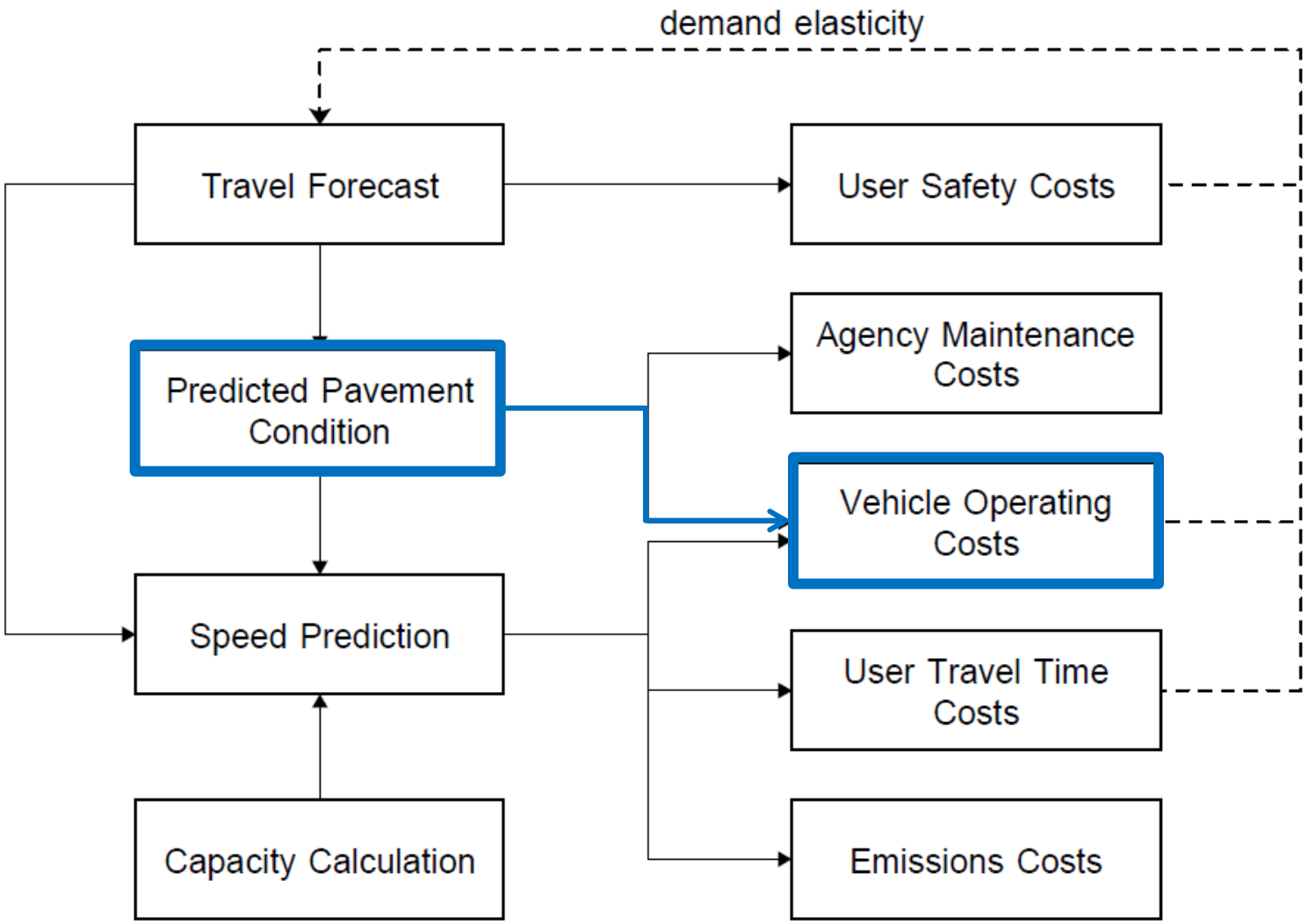
Pavement indicator example

- Use pavement condition model to:
  - Forecast resurfacing and reconstruction needs
  - Project cost of meeting long-range pavement targets (and facilitate making tradeoffs with other indicators)
  - Determine how TIP anticipates progress toward targets

Pavement model: HERS-ST

- Developed by FHWA
- Selects optimized set of improvements to highway system based on constraints
- May address geometric deficiencies, congestion, etc. but CMAP used only to address pavement condition
- Appropriate for use at network level (not a pavement management system)

HERS-ST continued



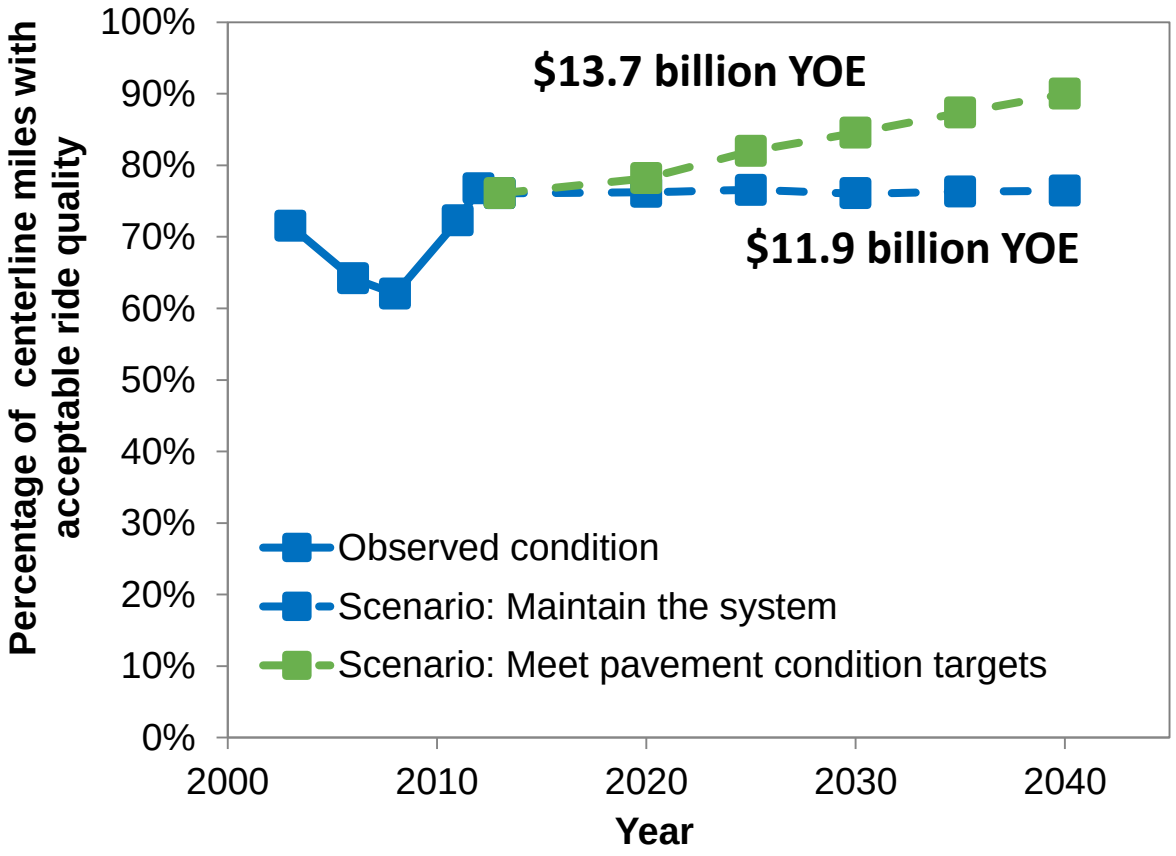
HERS-ST continued

- Performance-constrained mode
  - Forecast pavement condition
  - Identify deficient sections and any mandatory improvements
  - Determine improvement type and calculate benefit-cost ratio
  - Sort sections by BCR
  - Select projects in order of BCR until weighted system IRI ≤ target

Initial scenario overview

- Year-end 2013 IRIS file + Tollway data added manually
- Limited to NHS (best data available)
- 25 year horizon with 5 year funding periods
- Only resurfacing/reconstruction allowed
- Upcoming reconstructions were included as user-specified improvements
  - Eisenhower Expwy, Central Tri-State, Edens Spur
  - Included cost of pavement only

Initial scenario (con't)



Initial scenario (con’t)

- Benefits
  - Large reductions in vehicle operating costs
  - Slight reduction in agency maintenance costs
  - Slight and ambiguous effects on safety costs and travel time

Initial comparison to TIP

- MAP-21: document anticipated progress toward plan targets in the TIP
- Used HERS-ST to estimate IRI resulting from projects in the 2014-19 TIP
  - Includes all projects on NHS with resurfacing/reconstruction elements as of spring 2015
  - Completion year before 2020
  - Totals 97 projects

Initial comparison to TIP (con't)

- Results: decline from 76.3 to 67.8% of NHS centerline miles in acceptable condition
- Possible reasons
  - Projects with only state or local funding may not be recorded in TIP
  - Projects may be selected based on CRS or other measures besides IRI
  - Proposed investment may not be adequate to maintain system

Summary of potential approach for next plan

- Use pavement condition model to:
  - Forecast resurfacing/reconstruction needs
  - Project cost of meeting long-range pavement targets to facilitate making tradeoffs with other indicators
  - Determine how TIP is anticipated to make progress toward targets

Things to think about

- How does this work match up with similar state and local work?
- Can or should CRS be translated to IRI?
- Should regional targets be “rolled up” from local jurisdictions?
- Should non-NHS routes be considered? How does data availability impact methodology?
- Can we ensure the TIP has complete enough information to compare to targets?

Some details…

Pavement model

- Deterioration based on AASHTO 1993 guidelines and depends mostly on ESALs
- Measures
  - Model uses Present Serviceability Rating (PSR) and converts to IRI (PSR is 1 – 5 rating with 1 = deteriorated and 5 = new)
  - Results converted off-model from VMT weighted average IRI to percent of CL miles in acceptable condition
- Regional traffic growth assumed for all sections (=0.9 pct/year), will be disaggregated in future

More on the pavement model

- Deterioration rates
  - Default max = 0.3 PSR units /year, a bit high but reasonable based on 2006 to 2013 IRIS
  - Min rate based on typical life of pavement by type and time of last improvement
- Other parameters for AASHTO 1993 method were default in HERS-ST (prediction error, etc.)
- Issues with benefit calculations
  - Crash frequency not affected by pavement condition, just VMT → slight and counterintuitive increase in safety costs as pavement condition improves
  - Emissions rates do not decrease with speed to the degree they do in MOVES

Selected assumptions – costs, treatments

- Unit costs in current dollars:
  - Expressway resurfacing: $289K /lane mile
  - Expressway reconstruction: $4.12M /lane mile
  - Arterial/collector resurfacing: $206K /lane mile
  - Arterial/collector reconstruction:$1.65M /ln-mi
  - HERS-ST allows urban/rural cost inputs; no distinction has been made so far
- Only resurfacing or reconstruction in kind
  - Different pavement technologies, surface treatment or preventive maintenance not modeled in HERS-ST (e.g., IDOT 3P versus 3R projects)

Missing data

- Incomplete data in IRIS → used look up table developed from HPMS sample
  - Last overlay thickness
  - Thickness of rigid pavement
  - Thickness of flexible pavement
  - Base thickness
- No year for IRI in IRIS: assumed same as CRS
- Geometric deficiency and traffic signal data not present but have limited effect on pavement condition analysis

Next Steps

- Refine analysis based on comments
- Consider similar analysis for transit system
- Consider broadening HERS analysis to include congestion deficiencies
- Make any indicator changes needed when MAP-21 pavement condition rules are finalized

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