

# Best Practices for Guidelines for Inspection, Repair, and Use of Portable Concrete Barriers in Roadside Safety TRBAM-21-03356



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*Session*

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# BACKGROUND

- PCBs are the most widely used type of work zone barrier
- PCBs can incur damage while in transit, in storage, or due to vehicular impact.
- **Type of damages:**
  - *Cracks and spalling in concrete*
  - *Broken or bent connections*
  - *Reinforcement exposure and corrosion*
- **Damages influence**
  - *The segment strength, negatively compromising future barrier performance*
  - *Increase lateral deflection of the system.*
  - *Possibly leading to vehicular instability during subsequent vehicular impact.*
  - *A broken connection system increases the lateral deflection for the overall barrier system*

***No federal guidance has yet been developed to determine life expectancy or acceptability for PCBs***

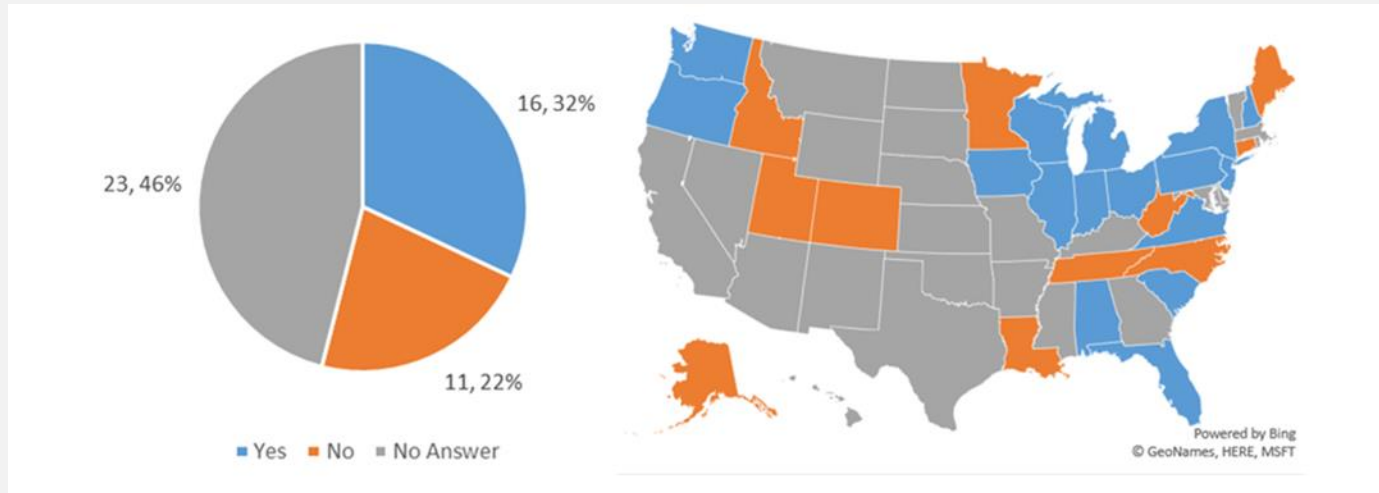
# Objectives

- Considering the lack of federal guidance on determining the life expectancy of PCBs, this study sought to gather information from DOTs to:
  - ❖ *Develop comprehensive quantitative guidelines for determining the service life of PCBs.*
- Exploring, through a **survey**, the current practices and available guidelines utilized by DOTs to evaluate PCBs.



# DOT Survey – Evaluation Criteria

Ques: Does your agency have evaluation criteria?



Responses	Agency
Yes	AL, FL, IL, IN, IA, MI, NH, NJ, NY, OH, OR, PA, SC, VA, WA, WI
No	AK, CO, CT, ID, LA, ME, MN, NC, TN, UT, WV
Other	-
No Answer	AZ, AR, CA, DE, GA, HI, KS, KY, MD, MA, MS, MO, MT, NE, NV, NM, ND, OK, RI, SD, TX, VT, WY

# Summary of responses – Crack measurements

DOT	Unacceptable Condition
New York	a- A barrier has more than one transverse crack through the section. b- A barrier has an open crack running more than 4 ft longitudinally. c- A single crack exhibits evidence that the reinforcing bar is rusting.
Illinois State Toll Highway Authority	a- Open cracks that extending completely through the barrier. b- Cracks extend from the edge of the wall base to the pinholes.
Florida	a- Cracks through the entire cross-section. b- An anchored barrier with broken concrete with shear cracks.
Kansas	a- Cracks propagate through both sides of the barrier
Illinois	a- A barrier has large cracks, with unsound concrete that could easily dislodge.
New Jersey	a- Cracking through the cross-section of the barrier
Ohio	a- One or more cracks with evidence of rusting. b- Two or more cracks that are located within, or extend to, the lower half of the wall.
Wisconsin	a- Open cracks with the cracks extending completely through the barrier.

# Crack measurements



(d) Multiple cracks



(e) Large crack



(f) A crack extends through the anchor hole.

(d) through (f) unacceptable conditions

Crack type	Most stringent Unacceptable condition
Transverse	2 (or more) Cracks through the entire cross-section
Longitudinal	One (or more) crack running more than four feet longitudinally
Transverse / Longitudinal	Single crack exhibits evidence that the reinforcing bar is rusting

## Summary of responses – Concrete Spalling

DOT	Unacceptable Conditions
New York	a- Spalled areas exceeding 12 in. in any direction. b- Spalled areas is 3 or more in. in depth at the barrier corner.
Illinois State Toll Highway Authority	a- Spalled area is greater than 2.5 in. in depth.
Florida	a- Spalled area is greater than 1.5 in. in depth. b- Any location with exposed reinforcing rebar.
Kansas	a- Spall dimension greater than 12" L * 3" D * 3" H.
Illinois	a- Spalled area is greater than 1.5 in. in depth. b- Any location with exposed reinforcing rebar.
New Jersey	a- Spalling area greater than 3 in. by 3 in. right triangle.
Ohio	a- A barrier has one or more spalls 12 in. or larger in any surface direction. b- Spalled area is greater than 1.5 in. in depth. c- Exposed reinforcing rebar.
Wisconsin	a- Spalling or chipping that is greater than 4 in. width.
Virginia	a- No exposed reinforcing rebar.
South Carolina	a- Spalling area of 1 in. (in all 3 dimensions), entirely or partially within the boundaries of the end connection areas and the drainage slot areas. b- Spalling area of 4 in. (in all 3 dimensions), for all areas beyond the end connection areas. c- Exposed reinforcing rebar.



# Spall measurements

Spall measurement	Most stringent unacceptable condition
Depth of spall	1.5 in.
Surface dimensions of spall	3 in. by 3 in.
	12 in. in any directions
	Any location with exposed reinforcing rebar
Volume of spall	1 in. (in all three dimensions), within the boundaries of the end connection areas and the drainage slot areas
	4 in. (in all three dimensions) for areas beyond connection areas



(d) Exposed reinforcing steel



(e) Large spalled area



(f) A large spalled area with exposed reinforcing bars

(d) through (f) unacceptable conditions

# Connection system

In general, unacceptable conditions:

- **Connection assemblies are deformed**
- **Bent**
- **Broken**
- **or no longer in a fixed position.**



(c) Exposed reinforcing steel



(d) Large spalled area

(c) through (d) unacceptable conditions

# Future Works

- **Survey findings**
- **Bogie tests**
- **Computer Simulations and**
- **Real crash tests**
  - ✓ Aid in the establishment of benchmarks to define the “normal service of life” of PCB segments
  - ✓ Determination of the preliminary guidelines to address the type and extent of barrier segment damage which would constitute replacement of the segment

Providing **quantitative measurements** play an important role in evaluation process and provide a concrete basis for engineers to make the most appropriate decisions.

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