REBEL® Concrete Sensor Test Results TXDOT Patch Projects

Summer 2023 – Fall 2024

- Wavelogix partnered with TXDOT on an 8-week program to test the REBEL Sensor on road patching projects to accelerate traffic opening.

- Each patching job deployed 4 REBEL Sensors: 3 in the patch and 1 in a 6” x 12” companion cylinder taken to the lab.

- Cylinders were broken at around 2, 4, 6, and 48 hours.

- The target for traffic opening was 1,800 psi at 6 hours.

- Across the 8-week period using the same mix design, there was a 27.9% variability for all cylinders and a 12.2% variability for all sensors.

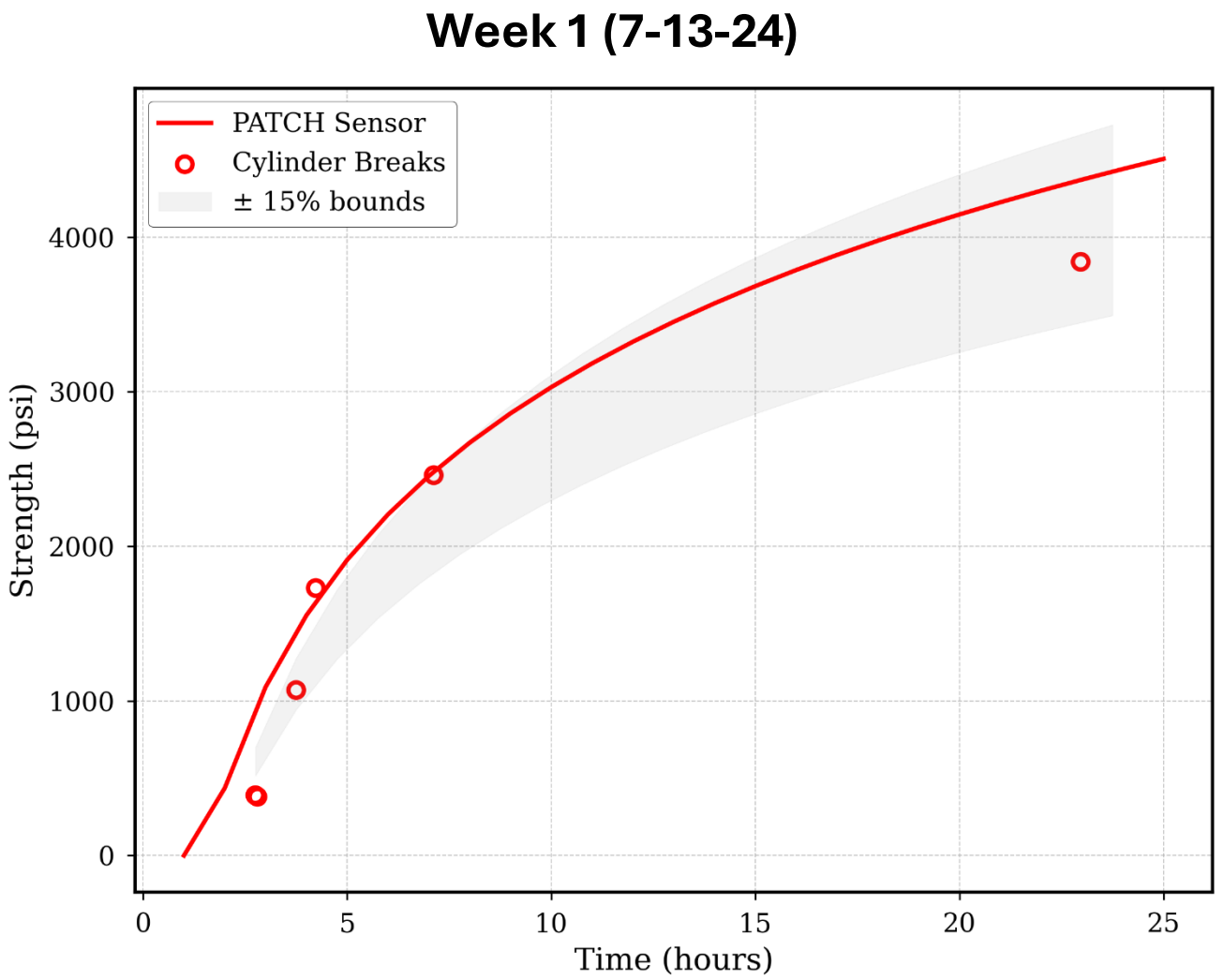
- On average, the REBEL sensor reported target strength 1 hour before cylinder breaks and, in one case, 44 hours earlier

Date	7-13-2024 to 9-21-2024
Location	Austin, TX
Project Type	Pavement Repair

Ingredients	**Amount (/yd^3)**
Fine Agg.	1205 lbs.
Coarse Agg.	1920 lbs.
Cement	800 lbs.
Water	258 lbs.
W/C Ratio	0.32

	REBEL Sensor	Cylinder Break
Target Traffic Open 1800 psi	4.8 Hours	7.1 Hours

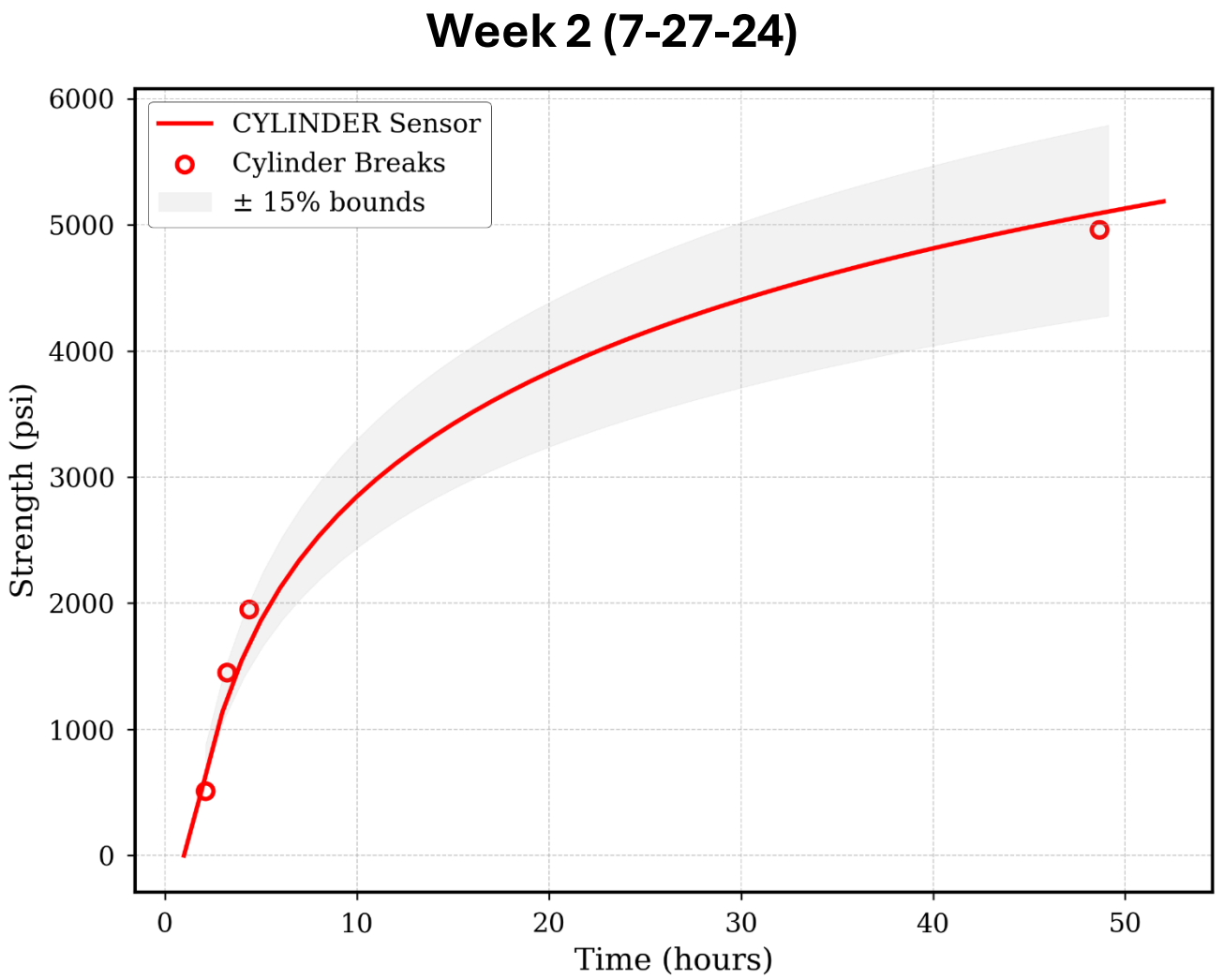
Age	Avg. Difference (psi)	Avg. Difference (%)
3-Hour	557	145.0
4-Hour	367	34.3
5-Hour	94	5.4
7-Hour	20	0.8
24-Hour	529	13.8



- The sensor in the patch failed so only the cylinder sensor is available

	REBEL Sensor	Cylinder Break
Target Traffic Open 1800 psi	4.8 Hours	4.4 Hours

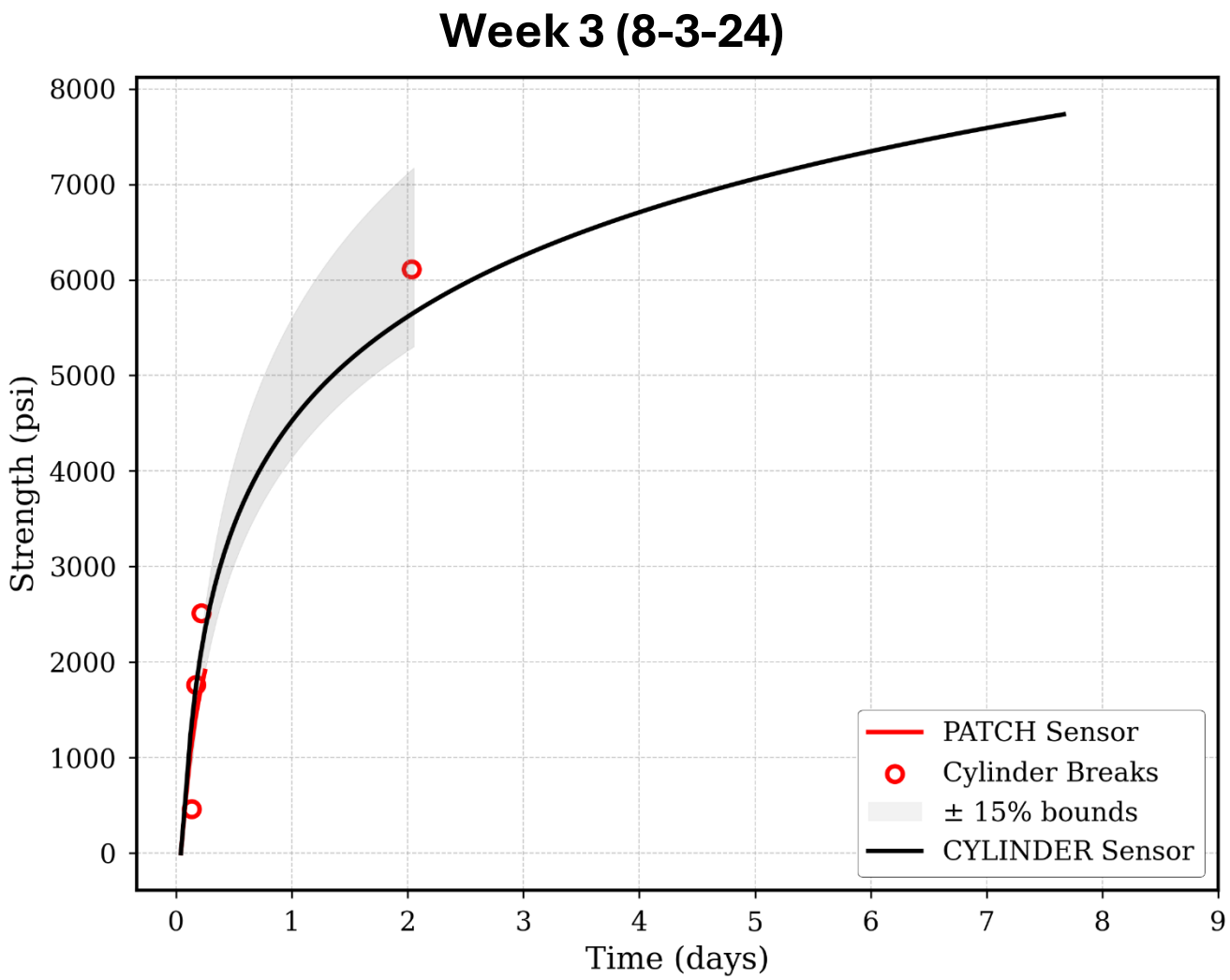
Age	Avg. Difference (psi)	Avg. Difference (%)
2-Hour	126	24.7
3-Hour	211	14.6
4-Hour	278	14.3
48-Hour	131	2.7



- The sensor in the patch was unplugged after 6 hours for traffic opening

	REBEL Sensor	Cylinder Break
Target Traffic Open 1800 psi	4.8 Hours	5.3 Hours

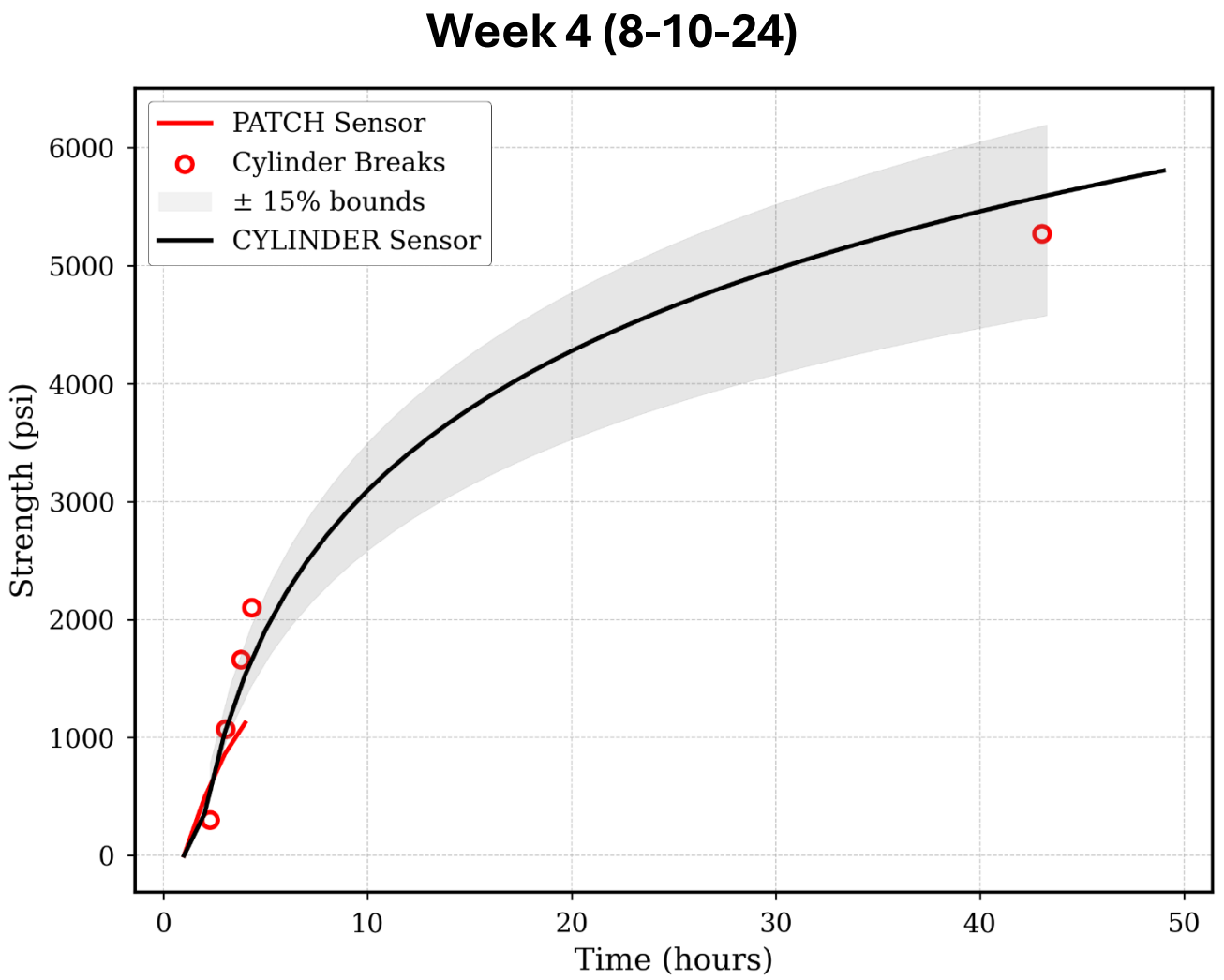
Age	Avg. Difference (psi)	Avg. Difference (%)
3-Hour	800	173.9
4-Hour	152	8.6
5-Hour	573	22.9
48-Hour	466	7.6



- The sensor in the patch was unplugged after 6 hours for traffic opening

	REBEL Sensor	Cylinder Break
Target Traffic Open 1800 psi	4.8 Hours	4.3 Hours

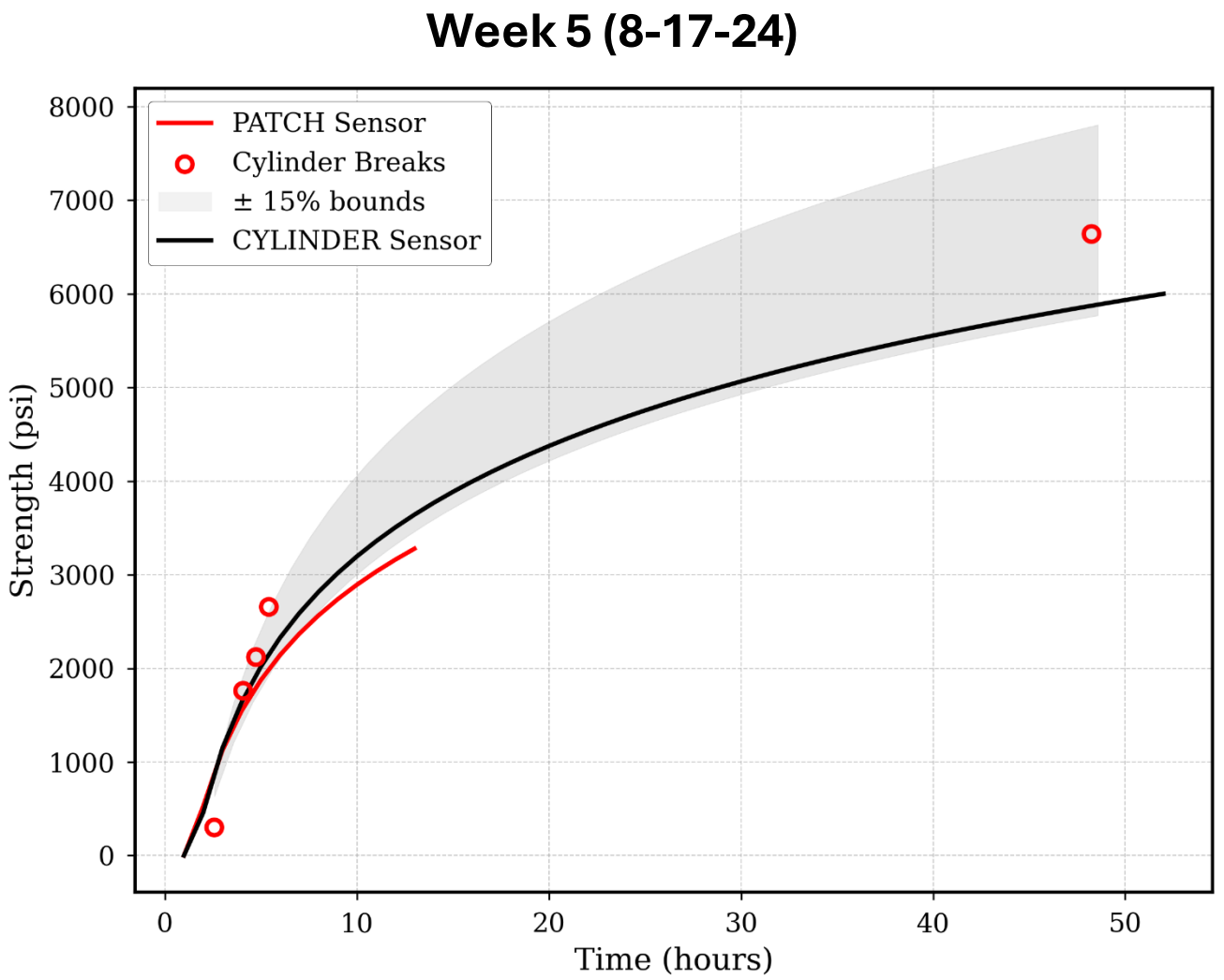
Age	Avg. Difference (psi)	Avg. Difference (%)
2-Hour	267	89.2
3-Hour	100	9.3
4-Hour	461	26.4
43-Hour	315	6.0



- The sensor in the patch was unplugged after 12 hours for traffic opening

	REBEL Sensor	Cylinder Break
Target Traffic Open 1800 psi	5.0 Hours	4.8 Hours

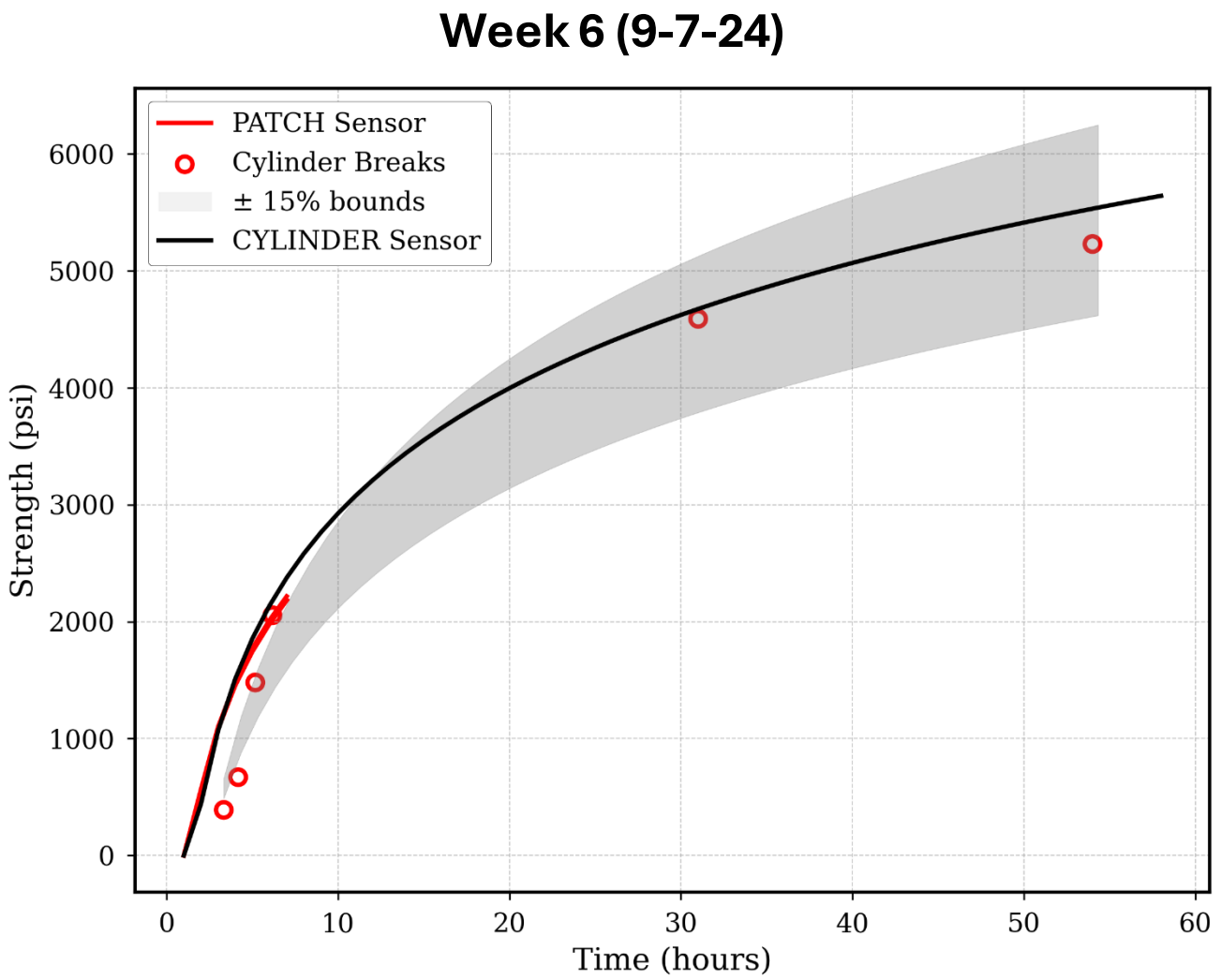
Age	Avg. Difference (psi)	Avg. Difference (%)
3-Hour	564	188.0
4-Hour	141	8.0
5-Hour	264	12.5
6-Hour	590	22.2
48-Hour	766	11.5



- The sensor in the patch was unplugged after 6 hours for traffic opening

	REBEL Sensor	Cylinder Break
Target Traffic Open 1800 psi	4.8 Hours	6.2 Hours

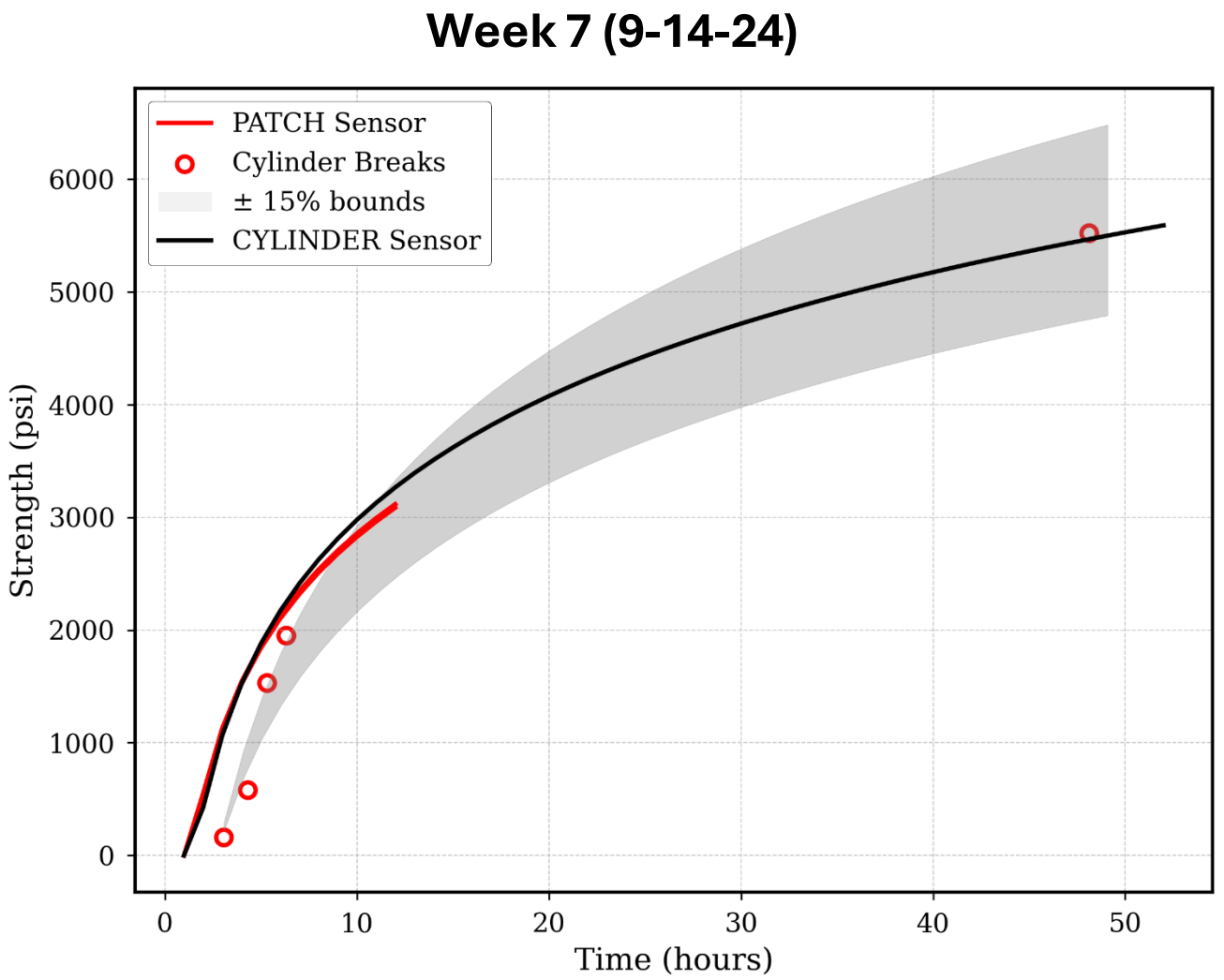
Age	Avg. Difference (psi)	Avg. Difference (%)
3-Hour	822	210.9
4-Hour	857	128.0
5-Hour	342	23.2
6-Hour	75	3.7
31-Hour	84	1.8
53-Hour	302	5.8



- The sensor in the patch was unplugged after 12 hours for traffic opening

	REBEL Sensor	Cylinder Break
Target Traffic Open 1800 psi	4.5 Hours	6.3 Hours

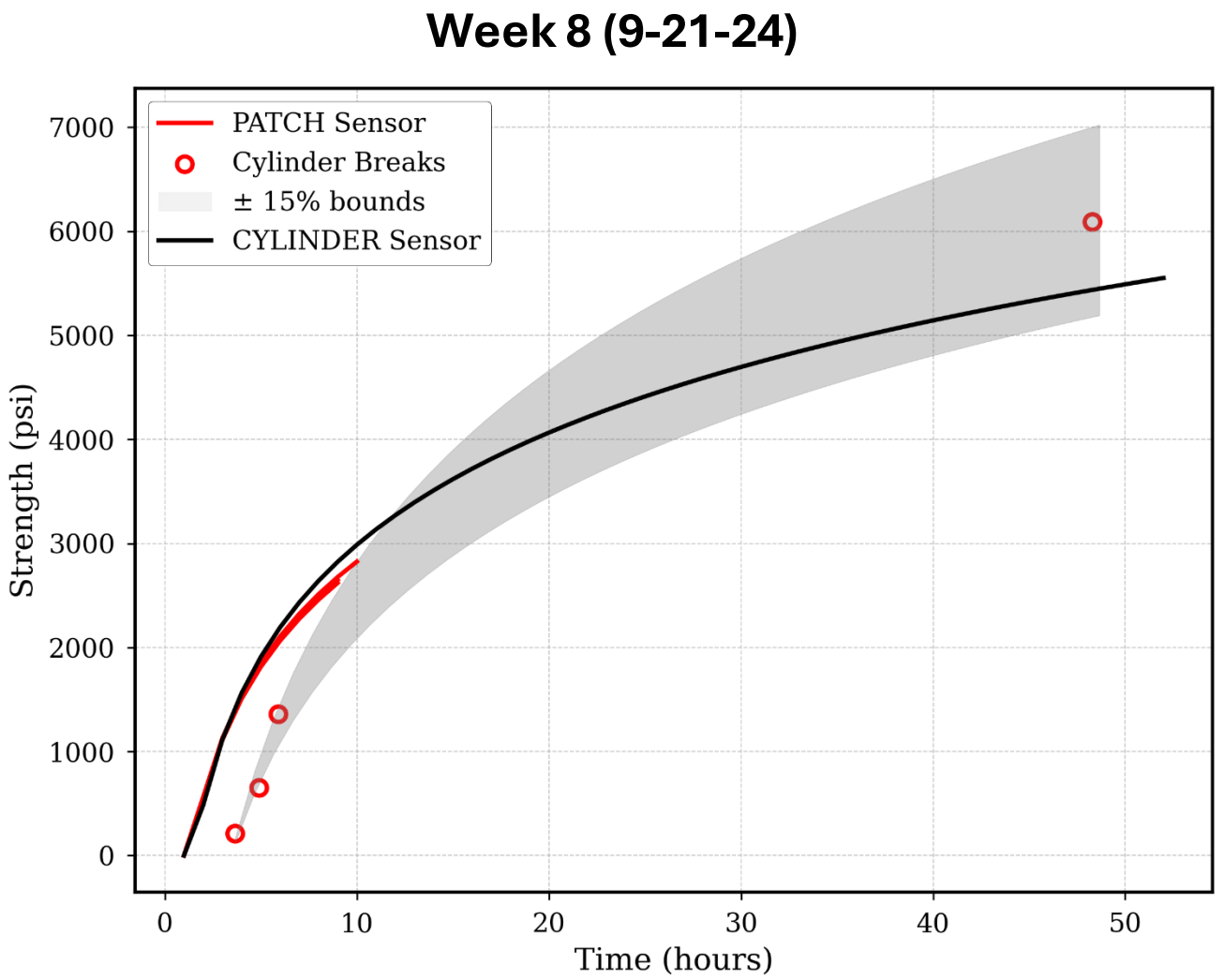
Age	Avg. Difference (psi)	Avg. Difference (%)
3-Hour	984	615.0
4-Hour	1060	182.9
5-Hour	418	27.4
6-Hour	252	12.9
48-Hour	52	1.0



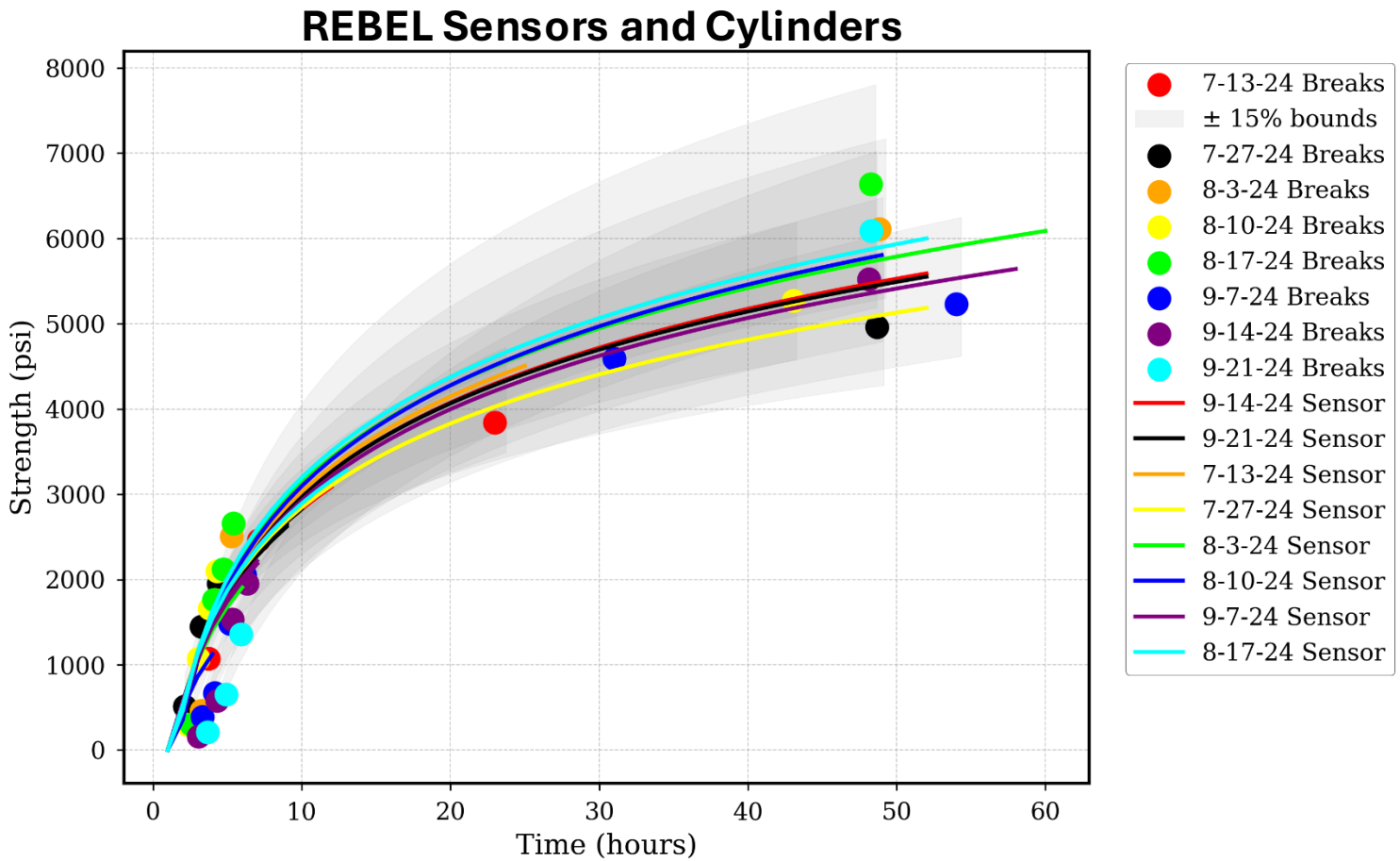
- The sensor in the patch was unplugged after 10 hours for traffic opening

	REBEL Sensor	Cylinder Break
Target Traffic Open 1800 psi	4.0 Hours	48.0 Hours

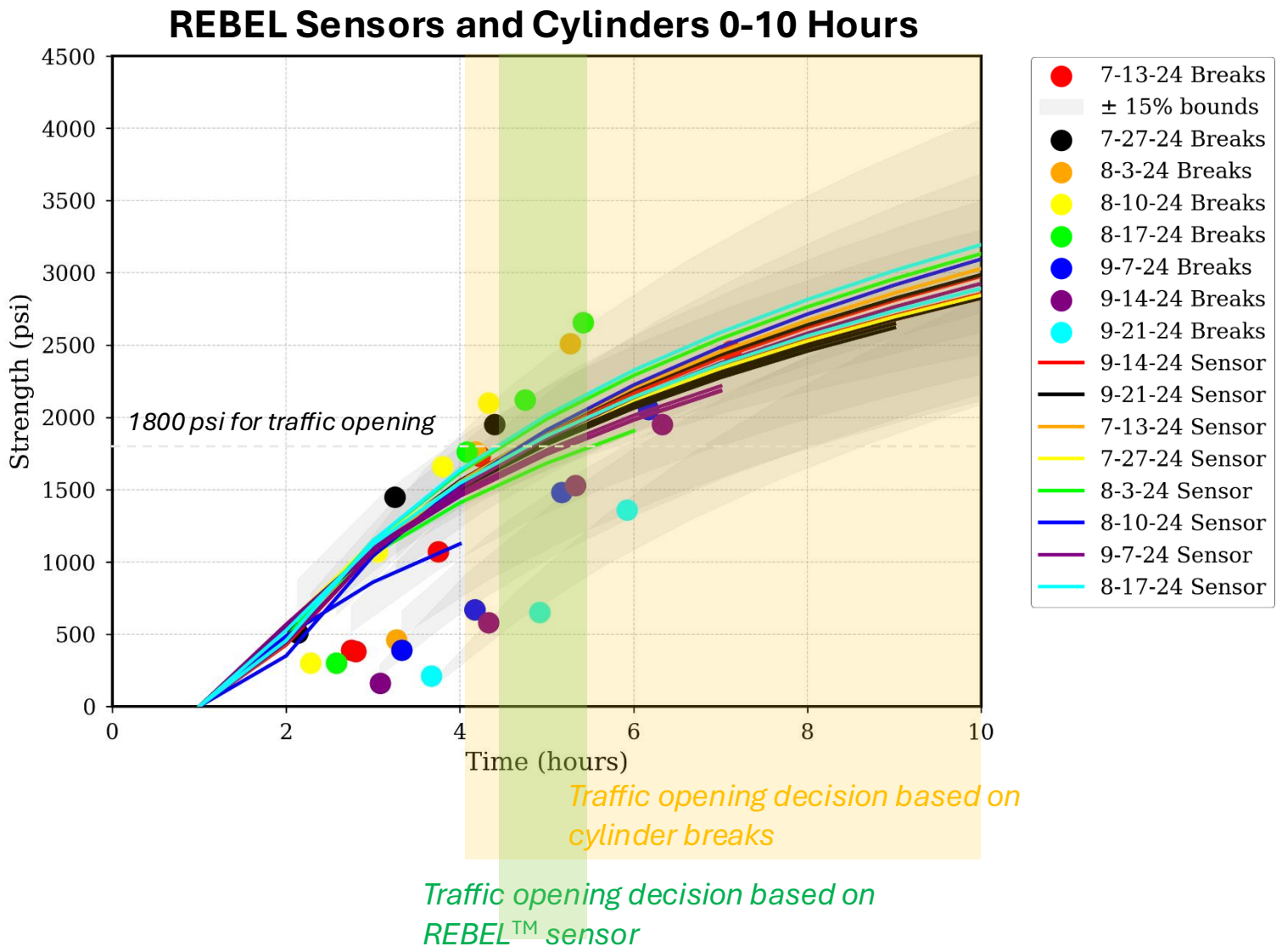
Age	Avg. Difference (psi)	Avg. Difference (%)
4-Hour	1185	564.5
5-Hour	1175	180.8
6-Hour	732	54.0
48-Hour	652	10.7



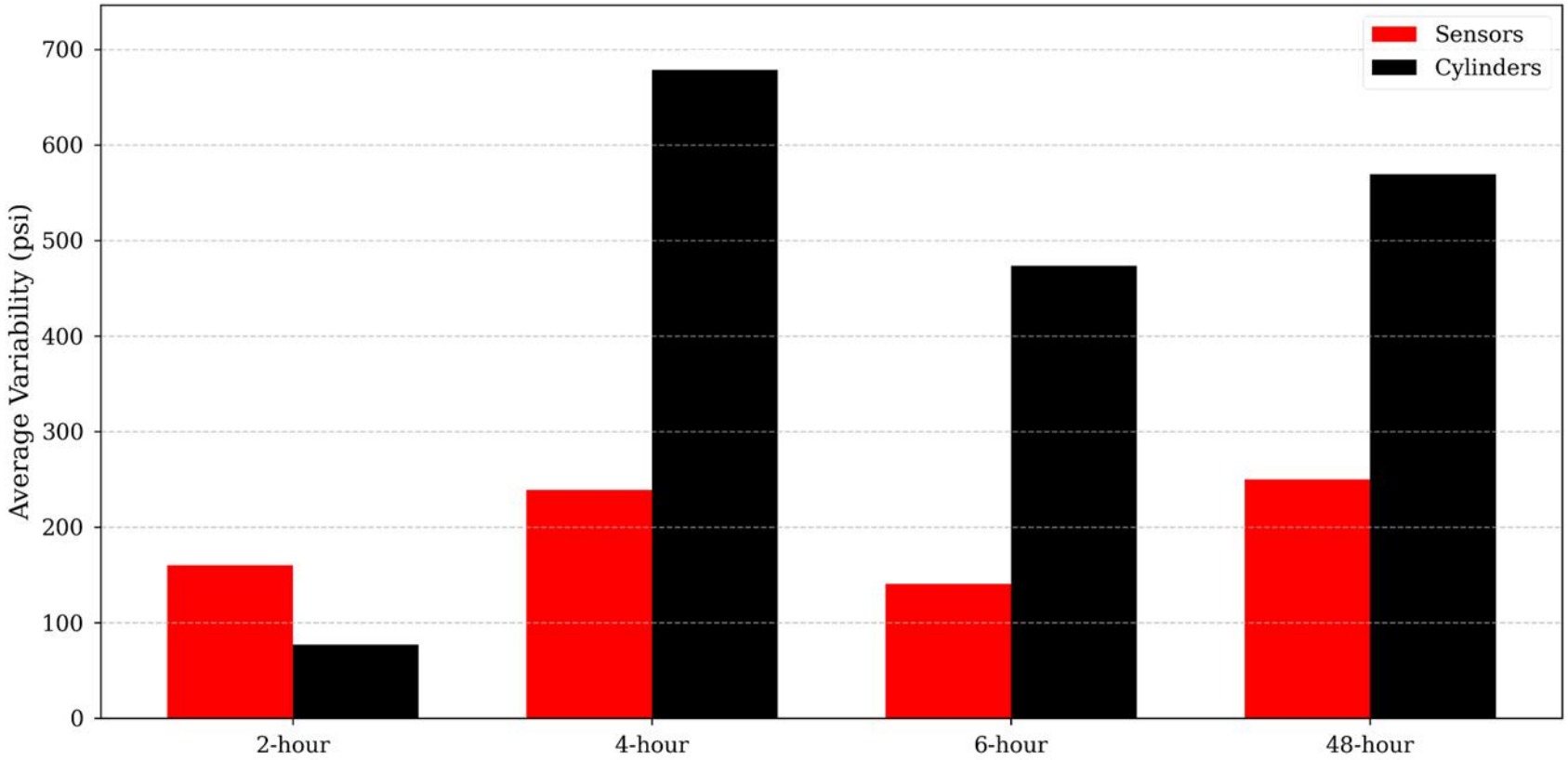
- The sensors had significantly less variability than the cylinders
- The sensor results are within 15% of the average of the cylinder results



- The sensors had significantly less variability than the cylinders
- **REBEL sensor indicates 5 hrs (4.5-5.5hrs) is the optimal traffic opening time; however; the cylinder shows 4-10 hrs;**
- **The current specs calls for 3 days traffic opening time; significant time saving could be realized using REBEL sensor.**

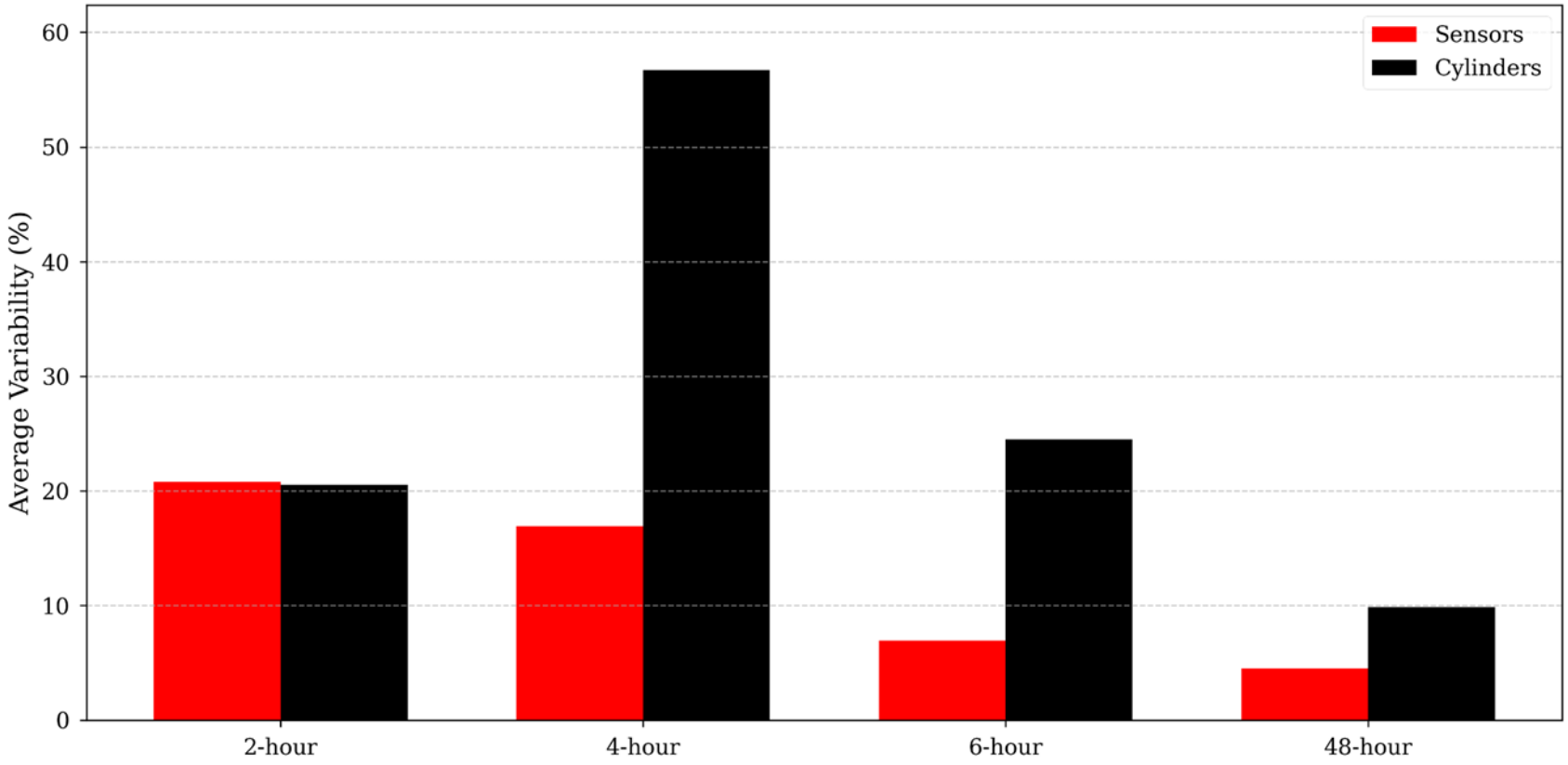


REBEL Sensor vs. Cylinders Variability Over Time



- The sensors had significantly less variability than the cylinders at 4, 6, and 48-hours

REBEL Sensor vs. Cylinders Variability Over Time



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- REBEL sensors have following features
  - Superior consistency than traditional cylinder break data
  - Closer strength measurements to core drill data than cylinder breaks
  - Real-time strength data measurements and reporting

- REBEL sensors are suitable for use cases including
  - Traffic opening time decision making
  - Concrete form stripping time decision making
  - Concrete QC/QA at both early (e.g., 1-day) and long term testing ages (e.g., 28-day)