

Project Title	BNSF SPJ - LPO Temporary Work Bridge 3.1
Pile information (size, type, number, pile strikes, etc.)	Impact Proof 10 24-inch-diameter steel piles (1 pile per pier) after vibratory to refusal; maximum 60 strikes/pile; 2-3 hours each install; 4 piles/day (2 simultaneously). Attenuated 3dB with bubble curtains.

Fill in green cells: estimated sound levels and distances at which they were measured, estimated number of pile strikes per day, and transmission loss constant.

	Acoustic Metric			
	Peak	SEL	RMS	Effective Quiet
Measured single strike level (dB)	204	175	191	150
Distance (m)	10	10	10	

Estimated number of strikes	240
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Cumulative SEL at measured distance	199
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	Distance (m) to threshold			
	Onset of Physical Injury			Behavior
	Peak dB	Cumulative SEL dB**		RMS dB
		Fish ≥ 2 g	Fish < 2 g	
Transmission loss constant (15 if unknown)	206	187	183	150
	15	7	61	113
				5412

** This calculation assumes that single strike SELs < 150 dB do not accumulate to cause injury (Effective Quiet)

Notes (source for estimates, etc.)

(This model was last updated January 26, 2009)

5,412 meters = 3.36 miles; 61 meters = 0.04 mile; 7 meters = 0.004 mile (2.1 feet)

Mitigated (levels for simultaneous driving of two piles at a time), measured 10 m from the pile, 24-inch steel pipe pile; per WSDOT BA Preparation Advanced Training Manual Version 4-2018, Table 7-12.

Number of strikes needed/24" pile for construction equipment load requirements - per BNSF

Project Title	BNSF SPJ - LPO Temporary Work Bridge 3.9
Pile information (size, type, number, pile strikes, etc.)	Impact Proof 76 24-inch-diameter steel piles (1 pile per pier) after vibratory to refusal; maximum 60 strikes/pile; 2-3 hours each install; 4 piles/day (2 simultaneously). Attenuated 3dB with bubble curtains.

Fill in green cells: estimated sound levels and distances at which they were measured, estimated number of pile strikes per day, and transmission loss constant.

	Acoustic Metric			
	Peak	SEL	RMS	Effective Quiet
Measured single strike level (dB)	204	175	191	150
Distance (m)	10	10	10	

Estimated number of strikes	240
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Cumulative SEL at measured distance	199
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	Distance (m) to threshold			
	Onset of Physical Injury			Behavior
	Peak dB	Cumulative SEL dB**		RMS dB
		Fish ≥ 2 g	Fish < 2 g	
Transmission loss constant (15 if unknown)	206	187	183	150
	15	7	61	113
				5412

** This calculation assumes that single strike SELs < 150 dB do not accumulate to cause injury (Effective Quiet)

Notes (source for estimates, etc.)

(This model was last updated January 26, 2009)

5,412 meters = 3.36 miles; 61 meters = 0.04 mile; 7 meters = 0.004 mile (2.1 feet)

Mitigated (levels for simultaneous driving of two piles at a time), measured 10 m from the pile, 24-inch steel pipe pile; per WSDOT BA Preparation Advanced Training Manual Version 4-2018, Table 7-12.

Number of strikes needed/24" pile for construction equipment load requirements - per BNSF

Attachment 2: Revised Threshold Distance and Areas Table (revised February 19, 2019)

Action	Pile Size (inch)	Zone of Injury⁽¹⁾ (distance)	Zone of Injury⁽¹⁾ (area in acres)	Zone of Behavioral Disturbance⁽¹⁾ (distance)	Zone of Behavioral Disturbance⁽¹⁾ (area in acres)	Duration (hours)	Notes
Bridge 3.1 Temporary Bridge	24	0.04 mile (61 meters)	2.9	3.4 miles (5,412 meters)	310	30	10 piles x 3 hours (conservative)
Bridge 3.9 Temporary Bridge	24	0.04 mile (61 meters)	2.9	3.4 miles (5,412 meters)	7,230	228	76 piles x 3 hours (conservative)
Bridge 3.1 Permanent Bridge	24	0.28 mile	19	3.36 miles	310	44	22 piles x 2 hours (conservative)
Bridge 3.9 Permanent Bridge	36	0.62 mile	830	2.88 miles	6,650	864	Biological Assessment presented 432 hours, assuming 2 piles will be driven at a time. However, if only one pile can be driven at a time, the duration would increase to 864 hours (288 piles x 3 hours, conservatively). Actual duration could range from 432 hours to 864 hours.

Note:

⁽¹⁾Red text indicates an updated distance or quantity.