



## Assessment of Pier Shape and Modifications on Scouring around Bridge Pier

## Rashid Farooq and Abdul Razzaq Ghumman

Rectangular (S2)	
\$ \$	Length ( $D_p = 5$ and 10 cm):
J <sub>2a</sub> J <sub>2b</sub>	$S_{2a}S_{2b} = S_{2d}S_{2c} = 15 \text{ cm}$
	Width ( $D_p = 5 \text{ cm}$ ):
	$S_{2a}S_{2d} = S_{2b}S_{2c} = 5 \text{ cm}$
	Width (10 cm):
S <sub>2d</sub> S <sub>2c</sub>	$S_{2a}S_{2d} = S_{2b}S_{2c} = 10 \text{ cm}$
Rhombus	Length ( $D_p = 5$ and 10 cm):
Sah	$S_{3a}S_{3c} = 15$ cm, $S_{3a}S_{3e} = S_{3e}S_{3c} = 7.5$ cm
-30	Width ( $D_p = 5 \text{ cm}$ ):
IS <sub>30</sub>	$S_{3b}S_{3d} = 5 \text{ cm}, S_{3b}S_{3e} = S_{3e}S_{3d} = 2.5 \text{ cm}$
S <sub>3a</sub> S <sub>3c</sub>	Width (10 cm):
	$S_{3b}S_{3d} = 10 \text{ cm}, S_{3b}S_{3e} = S_{3e}S_{3d} = 5 \text{ cm}$
Š <sub>34</sub>	
Sharp Nose (S4)	Length ( $D_p = 5$ and 10 cm):
	$S_{4a}S_{4d} = 15 \text{ cm}, S_{4g}S_{4h} = 9 \text{ cm}, S_{4a}S_{4g} = S_{4h}S_{4d} = 3 \text{ cm}$
$S_{4b}$ $S_{4c}$	Width ( $D_p = 5 \text{ cm}$ ):
	$S_{4b}S_{4f} = S_{4c}S_{4e} = 5 \text{ cm}$ , $S_{4b}S_{4g} = S_{4g}S_{4f} = S_{4c}S_{4b} = S_{4b}S_{4e} =$
$S_{4a} \leftarrow -r^{3_{4g}}s^{3_{4h}} - s^{3_{4h}} - s^{3_$	2.5 cm
	Width ( $D_{p} = 10 \text{ cm}$ ):
S	$S_{4b}S_{4b} = S_{4c}S_{4b} = 10 \text{ cm}$ $S_{4b}S_{4c} = S_{4c}S_{4b} = S_{4b}S_{4b} = S_{4b}S$
<b>J</b> <sub>4f</sub> <b>J</b> <sub>4e</sub>	5 cm
Octagonal (S5)	Length ( $D_p = 5$ and 10 cm):
S <sub>5b</sub> S <sub>5c</sub>	$S_{5a}S_{5d} = S_{5h}S_{5e} = 15 \text{ cm}, S_{5a}S_{5i} = S_{5j}S_{5d} = S_{5h}S_{5k} = S_{5l}S_{5e} =$
	$6 \text{cm}, S_{5i}S_{5j} = S_{5k}S_{5l} = 3 \text{ cm}$
S <sub>5a</sub> S <sub>5i</sub> S <sub>5j</sub> S <sub>5d</sub>	Width ( $D_p = 5 \text{ cm}$ ):
S =	$S_{5b}S_{5g} = S_{5c}S_{5f} = 5 \text{ cm}, S_{5b}S_{5i} = S_{5k}S_{5g} = S_{5c}S_{5j} = S_{5l}S_{5f} = 2$
<sup>-511</sup> <sup>-51</sup> <sup>-51</sup> <sup>-55</sup>	$cm, S_{5a}S_{5h} = S_{5i}S_{5k} = S_{5j}S_{5l} = S_{5d}S_{5e} = 1 cm$
S <sub>5g</sub> S <sub>5f</sub>	Width ( $D_p = 10 \text{ cm}$ ):
	$S_{5b}S_{5g} = S_{5c}S_{5f} = 10 \text{ cm}, S_{5b}S_{5i} = S_{5k}S_{5g} = S_{5c}S_{5j} = S_{5l}S_{5f} = 4$
	cm, $S_{5a}S_{5h} = S_{5i}S_{5k} = S_{5j}S_{5l} = S_{5d}S_{5e} = 2 \text{ cm}$
Filiptical (S4)	Length $(D_n = 5 \text{ and } 10 \text{ cm})$ :
	$S_{45}S_{45} = 15 \text{ cm} S_{45}S_{45} = 56S_{45} = 75 \text{ cm} S_{45}S_{45} = 86S_{45} = 45$
S <sub>ch</sub> S <sub>6c</sub> S <sub>c</sub>	$\cos 3\cos 10 \cos 10 \sin 10 \cos 10 \cos 10 \sin 10 \sin 1000 = 3000 \cos 10 \sin 10 \sin 1000 = 3000 \cos 10 \sin 1000 = 3000 \cos 1000 \cos 1000 = 3000 \cos 1000 \cos 1000 \cos 1000 \cos 1000 \cos 10000 = 30000 \cos 10000 \cos 100000 \cos 100000 \cos 100000 \cos 100000 \cos 10000000 \cos 100000000$
- 6d	$C_{11}, C_{00}, C_{00} = C_{00}, C_{00} = C_{00}, C_{00}$
$S_{6i} = S_{6i} = S_{6k} = S_{6k}$	$\begin{array}{c} \text{VIIIIII} (Dp = 5 \text{ CIII}). \\ \text{C}  \text{C} $
Joe Joe	36c36g = 0 CIII, $36c36j = 36j36g = 2.3$ CIII, $36b36h = 36d36f = 2$
S <sub>6h</sub> S <sub>6f</sub>	CIII, $36b36i = 36i36h = 36d36k = 36k36f = 1 \text{ CM}$
Jan J <sub>6g</sub> of	what $(D_p = 10 \text{ cm})$ :
	$5_{6c}5_{6g} = 10$ cm, $5_{6c}5_{6j} = 5_{6j}5_{6g} = 5$ cm, $5_{6b}5_{6h} = 5_{6d}5_{6f} = 4$
	$cm, S_{6b}S_{6i} = S_{6i}S_{6h} = S_{6d}S_{6k} = S_{6k}S_{6f} = 2 cm$

Table S1. Geometric parameters of pier shapes.



© 2019 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (http://creativecommons.org/licenses/by/4.0/).