

CHAPTER 2**DEMOLITION OF A BRIDGE****SECTION 3****CALCULATION FOR RESERVE DEMOLITION OF A BRIDGE**

0301. **Introduction.** Reserve Demolition of a bridge can be planned by destroying the abutment, pier and roadway of a bridge.

0302. **Calculation for Abutment (Masonry/Concrete).** Abutment can be demolition by mined charge or borehole charge.

a. **Mined Charge Calculation (Masonry)**

Ser	Type of Target	Type of Expl	Formula	Explanation of Formula	Data	Calculation	Fig	Auth
1.	Masonry Abutment	PE	$C = \frac{D^3}{50}$	C = Weight of Charge (lb) D = Dia of crater (feet)	D= 30'	$C = \frac{30^3}{50} = 540 \text{ lb}$	See Figure 2(a), 2(b) of auth.	GSTP-1603, Chapter-5, Section-31, Page 80~82.
2.	Roads/Medium and Hard soil	PE	$C = \frac{D^3}{100}$	C = Weight of Charge (lb) D = Dia of crater (feet)	D= 20'	$C = \frac{20^3}{100} = 80 \text{ lb}$		
3.	Soft soil	PE	$C = \frac{D^3}{200}$	C = Weight of Charge (lb) D = Dia of crater (feet)	D= 20'	$C = \frac{20^3}{200} = 40 \text{ lb}$		

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Number of Charges	n= 1	n = 2	n = 3	n = 4	n = 5
	30	$\frac{1}{2}(30+\frac{30}{3})=20$	$\frac{1}{3} \times 40$ = 13.33	$\frac{1}{4} \times 40 = 10$	$\frac{1}{5} \times 40 = 8$
C (Weight of charge in lb)= $\frac{D^3}{50}$ (Each Charge)	540	160	47	20	10
Total Explosive (lb) = C x n (Number of charge)	540	320 (160 ²)	141 (47 ³)	80 (20 ⁴)	50 (10 ⁵)
Distance from Face = $\frac{D}{4}$ - $\frac{D}{2}$ (feet)	7.5-15	5-10	3.5-6.5	2.5-5	2-4
Depth of Charge = $\frac{3}{2}(\frac{D}{4}$ - $\frac{D}{2})$ (feet)	11-22.5	7.5-15	5-10	4-7.5	3-6
Spacing of Charge = $\frac{2D}{3}$ (feet)	-	13	9	7	5
For minimum of Explosive, I will go for 5 craters. Total charge reqr= 50 lb.					

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b. **Borehole Charge Calculation (Masonry/Concrete Abutment).**

Ser	Type of Target	Type of Expl	Formula	Explanation of Formula	Data	Calculation	Fig	Auth
1.	Masonry Abutment up to 6' thickness (For 2 row)	PE	No of holes reqr in one row = $\frac{B}{3}$ Depth of hole = $\frac{2T}{3}$ ft	B = width of Abutment (feet) T = Thickness of abutment (feet)	B = 25 feet T = 6 feet	No of holes require in one row = $\frac{25}{3} = 8$, 3 rows require. Total no of holes = 8+7+8 = 23 nos (The holes will be placed staggered) Depth of hole = $\frac{2 \times 6}{3}$ feet = 4 feet = 48 inch	See Figure 2(a), 2(b) of auth.	Auth: GSTP-0003, Table 19, page 52-53
2.	Masonry Abutment up to 6'- 9' (For 3 row)	PE	Expl will be filled = $\frac{1}{2}$ x Depth of hole (inch)			Expl will be filled = $\frac{1}{2} \times 48 = 24$ inch		
3.	Concrete Abutment up to 6' thickness (For 3 row)	PE	Expl reqr = Expl will be filled x 2.5 oz (1 lb = 16 oz) * Holes will be 3 feet apart. Dia of each hole = 2" (Using auger).			Expl reqr = 24 x 2.5 oz = 60 oz		
4.	Concrete Abutment up to 9'-12' thickness (For 3 row (both side)	PE				Amount of charge = 23 x 60 oz = 1380 oz = 1380/16 lb = 86.25 lb (1 lb = 16 oz)		

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0303. **Calculation for Pier (Masonry/Concrete/RCC/Steel).**
charge or shaped charge.

Pier can be demolished by mined charge or borehole

a. **Borehole Charge Calculation (Masonry/Concrete)**

Ser	Type of Target	Type of Expl	Formula	Explanation of Formula	Data	Calculation	Fig	Auth
1.	Masonry pier up to 6' thickness (For 2 row)	PE	No of holes reqr in one row = $\frac{B}{3}$	B = width of Pier (ft) T = Thickness of Pier (ft)	B = 25 ft T = 6 ft	No of holes reqr in one row = $\frac{25}{3} = 8, 3$ rows reqr. Total no of holes = $8+7+8 = 23$ nos (The holes will be placed staggered) Depth of hole = $\frac{2 \times 6}{3}$ ft = 4 ft = 48 inch Expl will be filled = $\frac{1}{2} \times 48 \tilde{N} \tilde{N}$ = $24 \tilde{N} \tilde{N}$ Expl reqr = 24×2.5 oz = 60 oz In one pier, amount of charge = 23×60 oz = 1380 oz = $1380/16$ lb = 86.25 lb (1 lb = 16 oz)	See Figure 3(a), 3(b) of auth.	Auth: GSTP-0003, Table 19, page 52-53
2.	Masonry pier up to 6'- 9' (For 3 row)	PE	Depth of hole = $\frac{2T}{3}$ ft Expl will be					
3.	Concrete pier up to 6' thickness (For 3 row)	PE	filled = $\frac{1}{2} \times$ Depth of hole (inch)					
4.	Concrete pier up to 9'-12' thickness (For 3 row (both side))	PE	Expl require = Expl will be filled x 2.5 oz (1 lb = 16 oz) * Holes will be 3 ft apart. Dia of each hole = $2 \tilde{N} \tilde{N}$ (Using auger).					

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b. **Shaped Charge (RCC/Steel Pier-Hayrick).**

Ser	Type of Target	Type of Expl	Formula	Explanation of Formula	Data	Calculation	Fig	Auth
1	RCC/Steel Pier	Shaped Charge (Hayrick)	<p>Hayrick can cut $2\tilde{N}$ of the thickness of a pier. If the thickness is $>4\tilde{N}$, borehole/pier footing charge should be planned instead of hayrick. If the thickness of the pier is $<4\tilde{N}$, then the no of hayrick</p> $= \frac{\text{circumference of the pier (inch)}}{6 \text{ (inch)}}.$	One hayrick can cut 6 inch width of pier	3 ft	<p>The circumference of the said pier is Approximate 9 ft=108 inch. So, Hayrick require $=\frac{108}{6}$ nos = 18 Nos.</p>	See Figure 3(a), 3(c) of auth.	Auth: GSTP 0003, Sec-21, Para 7

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c. **Pier Footing Charge (Masonry/Concrete Pier).**

Ser	Type of Target	Type of Expl	Formula	Explanation of Formula	Data	Calculation	Fig	Auth
1.	Masonry/Concrete Piers up to 0'-6'	PE	$C = 10 T$ No of charge $= B/T$	C= wt of Charge (lb) T= Thickness of pier (ft) B = Width of pier (ft)	T = 5' B= 15'	C = 10^5 = 50 lb No of charge = B/T $(15/5) = 3$ Nos Total Expl reqr (50^3) = 150 lb	See Figure 3(a), 3(d) of auth.	GSTP-1603, Chapter-5, Sec-30, Page-78. Note a. The charges are spaced at the thickness of the pier apart. b. The level of ground on the downhill side of the pier must be at least 18 inch below that on the uphill side.
2.	Masonry/Concrete Piers up to 6'-9'	PE	$C = 20 T$ No of charge = B/T		T = 8' B= 24'	C = 20^8 = 160 lb No of charge = $(24/8)= 3$ Nos Total Expl reqr (160^3) = 480 lb		

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0304. **Calculation for Span, Beam/Girder and Roadway (RCC/Concrete).**
by pressure charge.

Beam/girder, span and Roadway can be dml

Ser	Type of Target	Type of Expl	Formula	Explanation of Formula	Data	Calculation	Figure	Auth
1.	Span, Beam/Girder and Roadway (RCC/Concrete)	PE	$C = 4H^2T$	C= Wt of Charge (lb) H= Total Height of roadway T= Thickness (ft)	H = 6' T = 2'	$C = 4 \times 6^2 \times 2$ $= 288 \text{ lb}$ $= 288 \times \frac{1}{3} = 96 \text{ lb}$ Amount of expl $\text{reqr} = 96 \times \frac{1}{3} = 32 \text{ lb}$ <u>Cal of sand bag</u> For 20 lb expl sandbag $\text{reqr} = 16 \text{ nos}$ $\therefore \text{'' } 32 \text{ lb '' ''}$ $\text{''} = \frac{16}{20} \times 32 = 26 \text{ Nos}$	See Figure 4(a), 4(b) of auth.	GSTP-1603, Chapter-5, Sec-28, page-75 Note: Addl effect can be obtained by air cone in the centre of the charge. So charge can be reduced by $\frac{1}{3}$.

0305-0400 Reserve.