CEMVS-EC-DS 12 April 2021

MEMORANDUM FOR CEMVS-OD-N

SUBJECT: Melvin Price Locks and Dam, M/V Kevin Michael Incident of 19 March 2021, Report of Damage to Dam Tainter Gates

1. At the request of CEMVS-OD-N, on 22 March 2021, Kyle Arentsen, Jeff Dinkelmann, and Robert Kelsey conducted an inspection of Tainter Gate #4, Tainter Gate #5, and Tainter Gate #7 from a manbasket. From the preliminary inspection from the manbasket, it was determined that a hands-on inspection was necessary to determine the full extent of the damage from the subject incident. On 23 March 2021, Kyle Arentsen and Robert Kelsey conducted an inspection of the Tainter Gates #2, #4, #5, #7, and #9 from a deck barge. Other personnel present for the inspection included Jim Adden, Central Area Navigation Manager, and Kyle Wiseman, Facility and Safety Specialist.

2. At the time of the subject incident the project was at open river with all Tainter gates out of the water; the river elevation upstream was Elevation 419.4, while the river elevation downstream was Elevation 418.3. The subject M/V was downbound and impacted the main lock upstream guidewall bullnose at approximately 1140 on 19 March 2021. Upon impact with the bullnose, the tow broke apart allowing the barges to careen towards the dam gates. Tainter Gate #2, #4, #5, #7, and #9 were impacted by the loose barges from the subject incident. The tow consisted of an assortment of loaded and empty barges, 15 in total.

3. No appreciable damage to Tainter Gate #2 and Tainter Gate #9 was observed from the subject incident.

4. Observed damage consists of the following.

    a. Tainter Gate #4. The wire rope connection assembly on the Illinois side of the gate was impacted. There is one missing keeper plate and minor gouges in the inboard cable connection bracket end plate (Photo 1). The impact sheared off the keeper plate bolts that are threaded into the cable socket. The nut and washer shim plate above inboard cable socket fractured approximately in half leaving the outboard side of the shim plate (Photo 2). Due to the missing portion of the nut and washer shim plate, the inboard wire rope is considered ineffective. The adjacent cable socket has a missing keeper plate bolt.

    b. Tainter Gate #5. The impact caused a perforation and deformation of the skin plate assembly at the bottom edge of the gate (Figure 1, Photo 3 and Photo 6); the skin plate assembly at the bottom edge of the gate consists of the 1/2" skin plate, 1 3/8" bottom plate, and 1" vertical plate (Figure 2). The start of the deformation in the skin plate assembly is located approximately 28' from the Missouri end of the gate. The deformation in the skin plate assembly is over an

area of 4-6” high x approximately 20’-0” wide. The bottom of the gate is deformed at the bottom edge, approximately 6” downstream at its maximum point. In this 20’-0” wide area, the vertical ribs (WT12x31) are severely deformed (Photo 4). At a minimum, nine vertical ribs will require replacement. The 1” vertical plate on the skin plate assembly has completely fractured near the maximum deformation in the skin plate (Photo 5). Some of the 1/2" horizontal plates welded above the pockets formed by the skin plate assembly and the vertical ribs are deformed in the area from the incident.

c. Tainter Gate #7. The impact caused two deformations in the skin plate upstream of the bottom girder flange (Photo 7 and 8). The deformations are approximately 1” deep by 12” wide. Slight gouges were noted on the bottom edge of the gate that resulted from the incident (Photo 9). Repairs to these areas will not be necessary.

5. Recommended Operating Restrictions. Following the initial inspection and discussion with OD personnel, it was concluded that it is safe to operate the Tainter gates in their current condition for normal operations until repairs can be performed. Since the bottom of the gate is damaged, flow under the gate may be upset and cause vibrations at low opening or complete gate closure settings. Operators should be advised to listen for vibrations and make slight adjustments that may alleviate such vibrations. EC-DS should be notified if gate vibrations are detected when the gates are put back in service.

6. Recommended Repairs.

   a. Tainter Gate #4. Replacement of the missing keeper plate, socket shims and missing keeper plate bolt should be completed as soon as reasonably possible. Work is required to be performed in a dewatered Tainter gate bay in order to disassemble the cable socket connection to install the new shims and properly tension the wire ropes. Due to galling of existing stainless steel items on the wire rope connection assemblies, individual items in the connection assembly may require replacement after disassembly.

   b. Tainter Gate #5. Repairs to Tainter Gate #5 are required to ensure long term reliability of the gate and should be completed as soon as reasonably possible.

      i. Skin Plate Assembly. The deformed 1/2” skin plate, 1-3/8” bottom plate, and 1” vertical plate should be removed and replaced over the approximate width of the damaged area noted in paragraph 4.b. In order to facilitate the welding of the top skin plate splice, it is recommended that the skin plate demolition line be the horizontal skin plate splice located directly above bottom girder flange (i.e. 7’-8” above the bottom of the gate). The replacement sections of the 1/2" skin plate and 1-3/8” bottom plate should be installed with complete joint penetration welds, ground flush and smooth, and have ultrasonic testing performed. The 1” vertical plate shall be installed with complete joint penetration welds between the replacement plate and original plate. All other welding for the skin plate assembly shall be in accordance with the as-builts. The

material for the existing 1-3/8” plate is ASTM A514; the replacement 1-3/8” plate should match the existing material.

ii. Vertical Ribs. The deformed vertical ribs should be removed and replaced. In order to facilitate the welding of the top splice between the replacement vertical ribs and original vertical ribs, it is recommended that the vertical rib demolition line be located at the horizontal skin plate splice located directly above the bottom girder flange (i.e. 7’-8” above the bottom of the gate). The replacement vertical ribs shall be installed with complete joint penetration welds at the top. All other welding of the vertical ribs to the gate shall be in accordance with the as-builts. The 1/2" plates located between the stems of the vertical ribs shall also be removed and replaced; the welding of the replacement 1/2" plate shall be in accordance with the as-builts.

iii. Painting. All affected areas repaired shall be painted with the Corps of Engineers Paint System 5-E-Z.

7. Cost Estimate for Repairs. EC-DS will work with OD-N to develop a cost estimate for these repairs.

Kyle Arentsen, PE, CWI
Structural Engineer
CEMVS-EC-DS

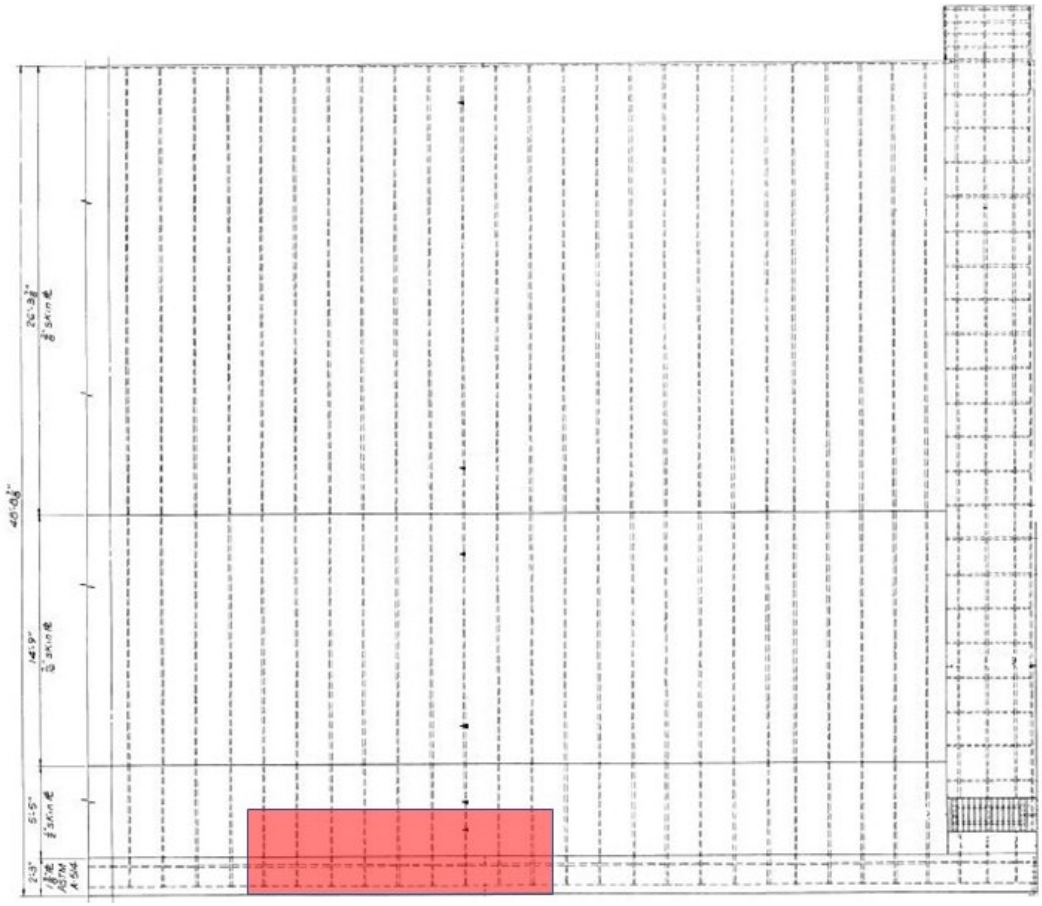

Figure 1 – Gate 5 Upstream Elevation, Missouri Side of Gate (shaded area indicates location of skin plate assembly damage)

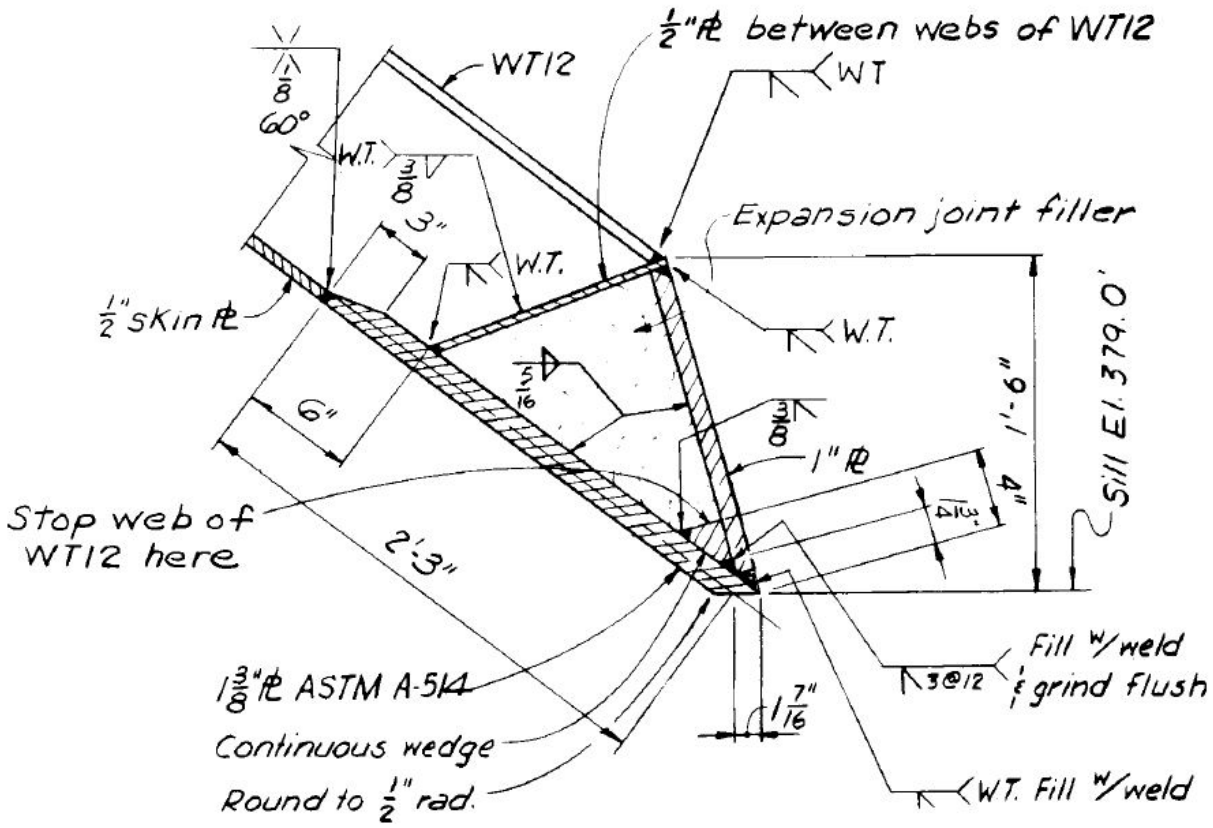

Figure 2 – Typical Skin Plate Assembly at Bottom Edge of Tainter Gate

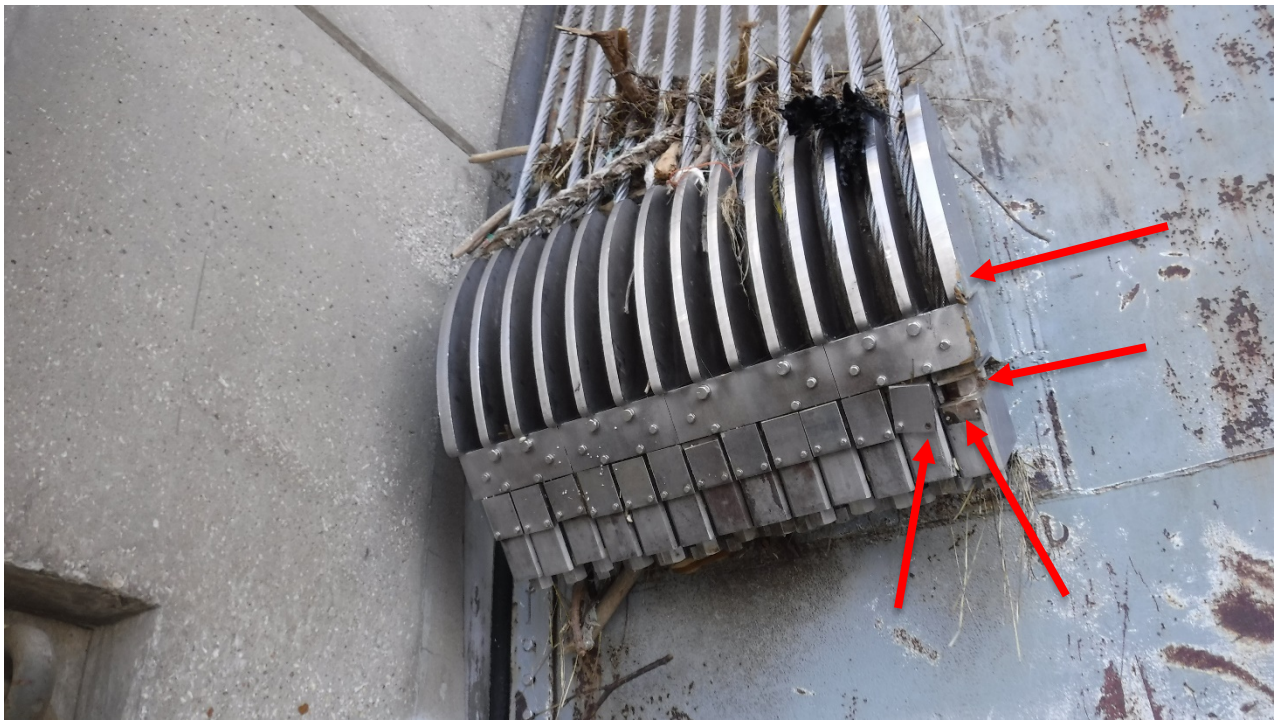

Photo 1 – Tainter Gate #4 – Illinois Wire Rope Connection . (Arrows indicate missing keeper plate and localized gouges in end plate, missing keeper plate bolt, and missing portion of nut and washer shim)

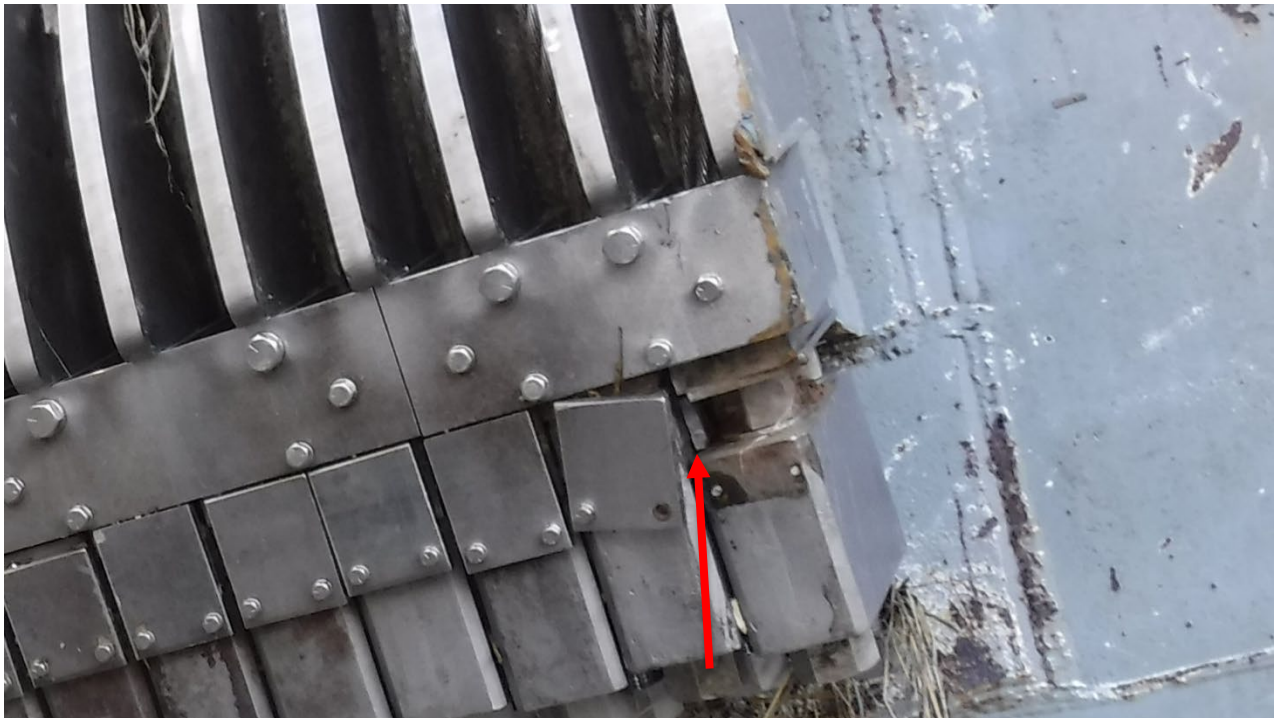

Photo 2 – Tainter Gate #4 - Zoomed in View of Fractured Nut and Washer Shim Plate on Inboard Cable Socket (Arrow indicates remaining portion of shim plate)

Photo 3- Tainter Gate #5 – Perforated Skin Plate

Photo 4 – Tainter Gate #5 – Deformed Vertical Ribs

Photo 5 – Tainter Gate #5 – Fracture of 1” Steel Plate

Photo 6 – Tainter Gate #5 – Approximate 6” Deformation in Bottom Portion of Skin Plate

Photo 7 – Tainter Gate #7 – Deformations in Skin Plate

Photo 8 – Tainter Gate #7 - Deformation in Skin Plate (view on downstream side of skin plate between vertical ribs)

Photo 9 – Tainter Gate #7 – Gouge in Bottom Edge of Skin Plate

Project Cost Estimate Overview

Job Title:	M/V Kevin Michael Allision Repairs	Start / End Date:	7/19/2021	9/17/2021

Labor Costs

Description	Total
B3R0N5A	$34,275.20
B3R0N5B	$0.00
B3R0N5C	$0.00
B3R0N5D	$56,674.80
B3R0N6C	$349,171.72
B3R0N00	$111,749.28
B3R0N50	$22,856.64
B3R0N60	$0.00
Total Labor Hours	5810
Total Labor Costs	$574,727.64

Floating Plant Costs

Description	Rate	Unit	Qty	Total	P2 Code
Grand Tower	$5,634.00	Per Day	2	$11,268.00	OTHNGSVC
Deck Cargo Barge	$3,345.00	Per Day	2	$6,690.00	GRPPLTSVC
DeLong 6811 (Tent Barge)	$2,917.00	Per Day	40	$116,680.00	GRPPLTSVC

General Supply & Material Costs

Resource Code	ORG Code	Description	Total
SUPMATRL	B3R0N5D	8' x 10' - 514 Steel / 1" x 5' x 10' a572, Weld Test Material	$14,000.00
SUPMATRL	B3R0N5D	1.5" x 2.5' x 20' - 514 Steel, Gate 5 Repair Material	$10,000.00
SUPMATRL	B3R0N5D	Tee WT12" x 31" HR - Rolled Stem Out, Flat 1/2" x 96" HR - Rolled Easyway	$16,500.00
SUPMATRL	B3R0N5D	4" X 20' x 1/2" a572 - Flat Bar, Gate 5 Repair Material	$1,000.00
SUPMATRL	B3R0N5D	1" x 5' x 10' a572, Gate 5 Repair Material	$2,000.00
SUPMATRL	B3R0N5D	3" x 3" x 20' a36 Square Stock, Gate 5 Repair Material	$1,000.00
SUPMATRL	B3R0N5D	Misc. Welding/Safety Supplies	$10,000.00
O&MCONT	B3R0N5D	Weld Testing Services	$6,000.00
		USACE Scour Survey	$9,000.00
		USACE Travel Orders	$15,000.00

Contract Costs

CLIN	Description	Qty	Unit	Unit Price	Total
10	FLOATING PLANT W/200 TN CRANE STANDBY	25	DY	$4,243.60	$106,090.00
8	FLOATING PLANT W/200 TN CRANE 12 HOUR DURATION	5	EA	$18,593.02	$92,965.10
35	FLOATING PLANT WITH MATERIAL BARGE W/SPUDS & RAMPS STANDBY	28	DY	$2,652.25	$74,263.00
33	FLOATING PLANT WITH MATERIAL BARGE W/SPUDS & RAMPS 12 HOUR DURATION	2	EA	$11,990.92	$23,981.84
6	FLOATING PLANT W/2000 TN CRANE MOBILIZATION & DEMOBILIZATION (TBD)	1	TBD	$60,000.00	$60,000.00
62	FORKLIFT (Min 5,000lb Capacity)	360	HR	$222.83	$80,218.80
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105	TOWABLE GENERATOR (500kW)	30	DY	$1,814.26	$54,427.80
109	RENTAL OF MISC. EQUIPMENT (TBD)	1	TBD	$250,000.00	$250,000.00
20	FLOATING PLANT W/400 TN CRANE STANDBY	7	DY	$7,956.75	$55,697.25
18	FLOATING PLANT W/400 TN CRANE 12 HOUR DURATION	14	EA	$30,038.25	$420,535.50
16	FLOATING PLANT W/400 TN CRANE MOBILIZATION & DEMOBILIZATION (TBD)	1	TBD	$30,000.00	$30,000.00
129	FOUR (4) MAN DIVE TEAM WITH FLOATING PLANT - 12 HOUR OPERATION	2	DY	$9,637.85	$19,275.70
57	8.5 TN CARRY DECK CRANE (Min 30Ft Reach)	134	HR	$864.44	$115,834.96
109	RENTAL OF MISC. EQUIPMENT (TBD)	1	TBD	$50,000.00	$50,000.00
64	OPERATOR - GROUP 2 – STRAIGHT TIME	12	HR	$124.99	$1,499.88
124	CARPENTER	504	HR	$113.39	$57,148.56

Master Ship Agreements

Scope of Work	Call Order Amount

Job Title:	M/V Kevin Michael Allision Repairs	Total Cost:	$2,366,022.83