Memorandum for Record

Subject: Water Jetting of miter gate, Rock Island District, Jul-Aug 02

Background

On 24-26 Jul 02 and again on 7-8 AUG 02 I visited the Rock Island District maintenance yards located at Lock & Dam No. 14, Le Clair, IA to observe waterjetting work taking place at the site. A contract had been awarded to L&P Painting of Cedar Rapids, IA for the waterjet surface preparation of 2 miter gates. The gates were had been removed from Lock No. 12, Bellevue, IA and were secured vertically on a maintenance barge in the maintenance yard. The barge was equipped with semi-permanent staging designed for work on miter gates. The specially designed barge provided excellent accessibility for working on the gates.

Contractor Operations

The contractor had a 3-man operation with 2 persons operating guns on the structure and one person operating the pump, air compressor and performing general maintenance and repairs. The pump was mounted in a van and water was supplied from a nearby spigot. Pump pressure was maintained at 37,000 psi. Water temperature at the gun was approximately 65°C (150°F). It was reported by others at the site that the contractor had numerous problems that delayed the start of the work, but at the time of my visit the operation appeared to be a matter of routine. The only equipment problem was frequent stoppage of the rotating head on the guns.

The 2 guns were different in length, but even the shorter of the 2 could not be positioned to efficiently clean the backsides of many structural members. Some members could not be cleaned and the shaded sides of many rivets could not be reached. (Some of these areas would also be difficult to clean with abrasive blasting. In some instances blasters accomplish thorough cleaning by ricocheting the abrasive off a nearby surface. This is not possible with water jetting.)

The paint being removed was a 26-year-old vinyl system consisting of a V-106 red iron oxide primer with a V-102 aluminum topcoat. It appeared that maintenance painting had been done above the waterline with paint in much of this area 50 – 75 μm thick (2-3 mils) while the paint on the majority of the underwater area was more commonly 250 – 300 μm (10-12 mils) thick. It appeared that the production rate may have been greater on the underwater area, but it is unknown if this was because of the greater thickness or because of the amount of underfilm corrosion in this area.

Production rates were monitored on 2 locations. Near the top of the gate 5 square feet of a structural member was cleaned in 6 minutes. The area contained 8 rivets and 1 joint. It was completely accessible and represented an ideal location. The second area, 40 square feet of area below the waterline, was cleaned in 45 minutes. This area was between 2 vertical structural members and had no horizontal members. Some paint remained behind the members where the worker was unable to point the gun directly at the surface.

At the end of each shift the District crew applied a coat of V-106 vinyl paint to the area cleaned. Application was by airless spray. (Airless is not a recommended

method of applying this coating.) The application contained entrapped air and pinholes in many locations.

Related Laboratory Work

While at the job site I located a piece of steel that had been flame cut from one of the gates. The piece was approximately 10 x 115 x 0.95 cm (4 x 45 x 3/8 inches). I asked the workers to waterjet the coating off the steel cleaning it to the quality they were obtaining on the actual gates. After cleaning it was noted that the one end of the steel had a much greater amount of the black underfilm corrosion due to a more constant immersion than the other end. After drying the steel was encased in plastic and brought to the laboratory. It was cut into 228 cm (9inch) test panels with Panel #1 having the least amount of black corrosion and Panel #4 having the greatest amount. Thoroughness of the surface preparation along the flame cut was WJ-4. The rating for the remainder of each panel is shown below. Each of four of the panels were coated with a different Corps of Engineer paint system as follows:

Panel #	Surface prep	Specification	Coating Type
1.	WJ-1	E-303 / C-200	Epoxy zinc / Coal Tar Epoxy
2.	WJ-3	C-200	Coal Tar Epoxy
3.	WJ-4	VZ-108 / V-766	Vinyl zinc / Vinyl
4.	WJ-4	V-766	Vinyl

The coating systems were spray applied according to the requirements published in the Corps of Engineers guide specification UFGS-09965. The panel edges were dipped and the coatings were allowed to age at laboratory conditions for 7 days prior to being scored and immersed in a tank of aerated potable water. Temperature of the water is maintained at 29°C (85°F).

After 3 days in immersion the panels were visually inspected. Panel #4 appeared to be developing small blisters on some of the underwater areas. Probing the coating with a knife revealed the coating could be stripped from the steel in the blister area. No blistering was noted on the other panels. Panel #3 was also probed at the score and found to have excellent adhesion.

After 6 months immersion the following observations were made:

Panel #1	No observable defects.
Panel #2	Dense #5 blisters on approximately 1/3 of the underwater portion of the panel.
Panel #3	Few to medium #5 blisters on approximately 1/5 of the underwater portion of the panel
Panel #4	Dense #7 blisters on the entire underwater portion of the panel.

Conclusions

Waterjetting was not able to clean the gate to the degree commonly specified for immersion service. The surface retained a lot of the black corrosion product commonly found on underwater areas and there were a lot of areas on the gate that were not accessible because of the size of the waterjetting gun. Some flash rusting took place before the steel dried but the amount was of little consequence given the low quality of surface preparation attained. Some coating systems may provide better performance on a

waterjetted surface than others. Initial testing indicates primers containing zinc may have a greater tolerance for the lower level of surface cleaning obtained by waterjetting.

Al Beitelman