

## Technical Report Documentation Page

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M&R RFS/ 6-61

**2. GOVERNMENT ACCESSION No.****3. RECIPIENT'S CATALOG No.****4. TITLE AND SUBTITLE**

Cathodic Protection Pacific State Hospital

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R. Stratfull

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State of California  
Department of Public Works  
Division of Highways  
Materials and Research Department

**10. WORK UNIT No.****11. CONTRACT OR GRANT No.****12. SPONSORING AGENCY NAME AND ADDRESS****13. TYPE OF REPORT & PERIOD COVERED****15. SUPPLEMENTARY NOTES****14. SPONSORING AGENCY CODE****16. ABSTRACT**

This report is about Cathodic Protection on the Pacific State Hospital. The report makes reference to a request of the department to inspect the application of cathodic protection to the lawn irrigation system at Pacific State Hospital, determine if the system is performing properly, and whether or not the obligations of the contract have been complied with.

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CATHODIC PROTECTION PACIFIC STATE HOSPITAL

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Cathodic Protection  
Pacific State Hospital

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Materials & Research Dept.

Mr. Wray N. Odell  
Departmental Construction & Maintenance Supervisor  
Department of Mental Hygiene  
Sacramento, California

Dear Mr. Odell:

Reference is made to your letter of June 1, 1961, requesting this department to (1) inspect the application of cathodic protection to the lawn irrigation system at Pacific State Hospital, (2) determine if the system is performing properly, and (3) if the obligations of the contract have been complied with.

The inspection of the system within the limits of contract was completed on June 5, 1961.

The results of the investigation are tabulated on Exhibits I and II and Tables 1 and 2. The apparent discrepancies between that written in the contract and the contractor's performance are as follows:

Contract - Section 2-12

Paragraph (a) requires contractor to electrically isolate pipe from buildings.

Discrepancy

Area B

Insulators were not installed at the following locations:

1. In the 4" cold water supply line servicing the school buildings.
2. In the water line servicing the All Purpose Unit (Auditorium).
3. In the cold water supply line which services the restroom in the recreation field, which is located across the street from Wards #31 and 32 (See Exhibit I).

Contract - Section 2-12

Paragraph (b) requires contractor to electrically isolate the automatic sprinkler controller from the cold water supply and the control tubing.

Discrepancy

Area B

The automatic sprinkler controller located in the recreation field across from Ward #31 and #32 has not been electrically insulated from the tubing nor the water line.

Contract - Section 2-15

Requires metering resistors to be installed where corrosive stray currents are detected.

Discrepancy

Area A

There is evidence that pipe beneath Buildings No. 4 and No. 5 are being subjected to stray electrical current and metering resistors have not been installed or are not effective.

Contract - Section 2-16

Requires contractor to make system electrically continuous.

Discrepancy

Area A

The sprinkler pipe along the fence at Cottage No. 3 as noted in Exhibit II is isolated from the cathodic protection system. (The date that this section of pipe was installed is not known; therefore the performance of contractor in executing this phase cannot be judged.)

Area B

The sprinkler pipe is not electrically continuous within the contract limits.

Recommendations

It is recommended that:

1. The cathodic protection system be monitored by the maintenance personnel as outlines in the original report on the corrosion of the pipe at this facility.

Area A

1. That a jumper wire be installed to the sprinkler pipe which is along the fence adjacent to Cottage No. 3. This location is shown on Exhibit II.

Area B

2. The automatic sprinkler control tubing in the recreation field be bonded together and insulated from the timer control head.
3. Additional jumpers, bonds, and insulating couplings should be installed as noted on Exhibits I and II.

Discussion

It should be understood that the number of jumper wires and bonds to the existing cathodic protection system shown on Exhibits I and II do not represent the total number that the contractor was required to install. They do indicate the general areas of piping that contain a high resistance or are electrically discontinuous. It was not economically feasible to conduct an extensive continuity survey to pinpoint all locations of high resistance and electrical discontinuity. Therefore the locations of the bonds and jumper wires shown on Exhibits I and II were generally determined by economics and engineering judgment.

Due to the absence of insulating couplings on the cold water lines servicing the auditorium and school buildings and the electrical discontinuities in the sprinkler system, this pipe is not under corrosion control. This fact was not only indicated by the survey but also by the fact that the pipe in this area has had four leaks since May of this year.

It is not known at this time whether or not the existing facilities are adequate and will completely control the corrosion of the pipe in the unprotected areas. Future tests, after the completion of these recommendations will be necessary to determine if additional anodes and rectifiers will be needed.

It is suggested that the hospital maintenance personnel install the necessary jumpers, bonds, and insulating couplings. The use of local maintenance personnel will insure a degree of flexibility in design and operation that may not be had by a contractor who will be under the limitations of a contract. Upon completion of this work, it will be necessary to perform further field tests to verify the intended purpose of the suggested installations, which we can do at your request.

It was observed that two of the rectifiers at Ward 27 had been turned to the "off" position prior to the time of this operational investigation. Therefore, it is not known whether or not the contractor was negligent in putting the rectifier

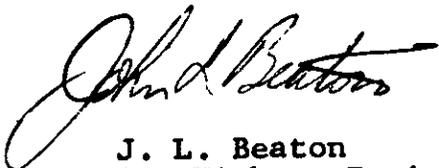
into operation or if it had been turned off by the hospital personnel. It is suggested that the hospital maintenance staff make a weekly inspection of the rectifiers so that they may control and limit any accidental or mischievous changes in the operation of the cathodic protection system.

Pipe to soil measurements for the 10 check points have been tabulated on Table 1. This table compares the contractor's readings with the Materials and Research Department's readings.

The rectifier settings noted on Table 2 were used during the survey and were not changed upon completion of the potential survey except for the rectifier located at the auditorium. Since this rectifier in the auditorium was not providing sufficient current to perform an effective potential survey, a testing rectifier was used and set at 27 volts and 18 amp. Upon completion of the survey, the original rectifier in the auditorium was turned back on and then was adjusted to an operational output of 12 volts and 18 amp.

It should be noted that any new sprinkler pipe added to the existing sprinkler system under cathodic protection will have an influence on the system as far as current requirements are concerned. Any new steel sprinkler pipe should be electrically connected to the existing system and brought under the proper degree of protection by adjustment of the rectifier used for that particular system.

F. N. Hveem  
Materials and Research Engineer

By   
J. L. Beaton  
Supervising Highway Engineer

RFS/GRS/WSM:mnw  
Attach.  
cc: OEAnderson  
GMGrove (Pac. State Hosp.)  
LRGillis

POTENTIAL READINGS AT PACIFIC STATE HOSPITAL BEFORE AND AFTER INSTALLATION OF

THE CATHODIC PROTECTION SYSTEM

Check Point Number	Original Potentials	Potentials After Rectifier Turned On	Potentials After 7 Days	*Potentials After 30 Days	*Potentials After 1 Year
1	.465	1.1	.635	.46	.46
2	.510	.980	.600	.76	1.0
3	.410	.490	.525	.53	.96
4	.350	.700	.410	.61	.72
5	.480	.890	.660	.55	1.0
6	.520	.800	.600	.48	.62
7	.470	.760	.470	.60	.66
8	.410	.490	.400	.55	.86
9	.530	.550	.530	.82	1.2
10	.520	.860	.680	.84	1.1

Notes:

\* These measurements obtained by the Materials and Research Department and referenced to copper sulfate half-cell electrode.

All readings in volts.

TABLE 1

RECTIFIER SETTINGS

Auditorium	12 volts	8 amps	
	27 volts	18 amps	
Ward #33	12 volts	6 amps	} parallel
	12 volts	5 amps	
Ward #27	7 volts	10.5 amps	
	7 volts	10 amps	
Ward #24	10 volts	11.5 amps	
Ward #22	12 volts	7 amps	
	9 volts	10 amps	
Ward #5	11 volts	8 amps	} parallel
	11 volts	9 amps	
	12 volts	4 amps	