

## DISTRIBUTION SHEET

|  |                                       |                           |
|--|---------------------------------------|---------------------------|
| <b>To</b><br>South General Area Services   | <b>From</b><br>Structural Assessments | <b>Page 1 of 1</b>        |
|  |                                       | <b>Date</b> June 15, 1994 |
| <b>Project Title/Work Order</b><br>Load Test of the 3701U Building Roof Deck and Support Structure |                                       | <b>EDT No.</b> 605919     |
|  |                                       | <b>ECN No.</b> N/A        |

| Name          | MSIN  | Text With All Attach. | Text Only | Attach./Appendix Only | EDT/ECN Only |
|---------------|-------|-----------------------|-----------|-----------------------|--------------|
| Conrads, TJ   | H5-55 | X                     |           |                       |              |
| Cooley, CL    | L6-57 | X                     |           |                       |              |
| Davis, PL     | H5-55 | X                     |           |                       |              |
| Gonzales, R   | S2-32 | X                     |           |                       |              |
| Hartman, CM   | S6-21 | X                     |           |                       |              |
| Hays, WH      | L6-53 | X                     |           |                       |              |
| McCoy, RM     | H5-55 | X                     |           |                       |              |
| Sharma, AK    | H5-60 | X                     |           |                       |              |
| Shipler, CE   | B4-53 | X                     |           |                       |              |
| Smith, KH     | L6-69 | X                     |           |                       |              |
| Central Files | L8-04 |                       |           |                       |              |
| OSTI (2)      | L8-07 |                       |           |                       |              |

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SEP 14 1994  
35 Station 21

ENGINEERING DATA TRANSMITTAL

Page 1 of 1  
1. EDT 605919

|   |   |   |
|---|---|---|
| 2. To: (Receiving Organization)<br>South General Area Services  | 3. From: (Originating Organization)<br>Structural Assessments | 4. Related EDT No.:<br>N/A                |
| 5. Proj./Prog./Dept./Div.:<br>Roof Inspections  | 6. Cog. Engr.:<br>R. M. McCoy                                 | 7. Purchase Order No.:<br>N/A             |
| 8. Originator Remarks:<br>This reports the results of the load test of the 3701U Building roof deck and support structure |   | 9. Equip./Component No.:<br>N/A           |
|   |   | 10. System/Bldg./Facility:<br>N/A         |
| 11. Receiver Remarks:   |   | 12. Major Assm. Dwg. No.:<br>N/A          |
|   |   | 13. Permit/Permit Application No.:<br>N/A |
|   |   | 14. Required Response Date:<br>06/29/94   |

| 15. DATA TRANSMITTED |                          |               |              |   | (F)          | (G)                    | (H)                    | (I)                  |
|----------------------|--------------------------|---------------|--------------|---|--------------|------------------------|------------------------|----------------------|
| (A) Item No.         | (B) Document/Drawing No. | (C) Sheet No. | (D) Rev. No. | (E) Title or Description of Data Transmitted                    | Impact Level | Reason for Transmittal | Originator Disposition | Receiver Disposition |
| 1                    | WHC-SD-GN-TRP-30010      |               | 0            | Load Test of the 3701U Building Roof Deck and Support Structure | SQ           | 1                      | 1                      |                      |

| 16. KEY                      |   |  |
|------------------------------|---|--|
| Impact Level (F)             | Reason for Transmittal (G)  | Disposition (H) & (I)  |
| 1, 2, 3, or 4 (see MRP 5.43) | 1. Approval<br>2. Release<br>3. Information<br>4. Review<br>5. Post-Review<br>6. Dist. (Receipt Acknow. Required) | 1. Approved<br>2. Approved w/comment<br>3. Disapproved w/comment<br>4. Reviewed no/comment<br>5. Reviewed w/comment<br>6. Receipt acknowledged |

| (G)    |       | (H)                    | 17. SIGNATURE/DISTRIBUTION<br>(See Impact Level for required signatures) |          |          |          |               |          |          |        | (G)   | (H) |
|--------|-------|------------------------|--|----------|----------|----------|---------------|----------|----------|--------|-------|-----|
| Reason | Disp. | (J) Name               | (K) Signature  | (L) Date | (M) MSIN | (J) Name | (K) Signature | (L) Date | (M) MSIN | Reason | Disp. |     |
| 1      | 1     | Cog. Eng. R. M. McCoy  | <i>[Signature]</i>   | 8/12/94  | H5-55    |          |               |          |          |        |       |     |
| 1      | 1     | Cog. Mgr. T.J. Conrads | <i>[Signature]</i>   | 8/12/94  | H5-55    |          |               |          |          |        |       |     |
| 1      | 1     | QA A.K. Sharma         | <i>[Signature]</i>   | 9/16/94  | H5-60    |          |               |          |          |        |       |     |
| 1      | 1     | Safety C.M. Hartman    | <i>[Signature]</i>   | 9/16/94  | H5-54    | 510-21   |               |          |          |        |       |     |
|        |       | Env.                   |  |          |          |          |               |          |          |        |       |     |

|   |  |   |  |
|---|--|---|--|
| 18.<br>R. M. McCoy<br><i>[Signature]</i><br>Signature of EDT Originator<br>Date: 8-1-94 | 19.<br>W. H. Hays<br><i>[Signature]</i><br>Authorized Representative for Receiving Organization<br>Date: 8/12/94 | 20.<br>T. J. Conrads<br><i>[Signature]</i><br>Cognizant/Project Engineer's Manager<br>Date: 9/12/94 | 21. DOE APPROVAL (if required)<br>Ltr. No. N/A<br><input type="checkbox"/> Approved<br><input type="checkbox"/> Approved w/comments<br><input type="checkbox"/> Disapproved w/comments |
|---|--|---|--|

BD-7400-172-2 (07/91) GEF097

A-6000-135 (01/93) WEF067

BD-7400-172-1 (07/91)

**RELEASE AUTHORIZATION**

**Document Number:** WHC-SD-GN-TRP-30010, REV. 0

**Document Title:** Load Test of the 3701U Building Roof Deck and Support Structure

**Release Date:** 9/14/94

\* \* \* \* \*

This document was reviewed following the procedures described in WHC-CM-3-4 and is:

**APPROVED FOR PUBLIC RELEASE**

\* \* \* \* \*

**WHC Information Release Administration Specialist:**

N. L. Solis N.L. SOLIS

**(Signature)**

9/14/94

**(Date)**

| SUPPORTING DOCUMENT   |   | 1. Total Pages <sup>25</sup><br>27  |
|---|---|---|
| 2. Title<br>Load Test of the 3701U Building Roof Deck and Support Structure   | 3. Number<br>WHC-SD-GN-TRP-30010  | 4. Rev No.<br>0   |
| 5. Key Words<br>roof inspections, load test<br><br><b>APPROVED FOR<br/>PUBLIC RELEASE</b>   | 6. Author<br>Name: R. M. McCoy<br><i>R. M. McCoy</i><br>Signature<br>Organization/Charge Code 8D440/MD2GA |   |
| 7. Abstract<br><i>9/14/94/D. Soles</i><br>This reports the results of the load test of the 3701U Building roof deck and support structure   |   |   |
| <del>8. PURPOSE AND USE OF DOCUMENT - This document was prepared for use within the U.S. Department of Energy and its contractors. It is to be used only to perform, direct, or integrate work under U.S. Department of Energy contracts. This document is not approved for public release until reviewed.</del><br><br><del>PATENT STATUS - This document copy, since it is transmitted in advance of patent clearance, is made available in confidence solely for use in performance of work under contracts with the U.S. Department of Energy. This document is not to be published nor its contents otherwise disseminated or used for purposes other than specified above before patent approval for such release or use has been secured, upon request, from the Patent Counsel, U.S. Department of Energy Field Office, Richland, WA.</del><br><br><del>DISCLAIMER - This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, nor any of their contractors, subcontractors or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or any third party's use or the results of such use of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.</del> |   | 10. RELEASE STAMP<br><br><div style="border: 1px solid black; padding: 5px; text-align: center;"> OFFICIAL RELEASE<br/> BY WHC<br/> DATE SEP 14 1994<br/> 35 Station 4 </div> |
| 9. Impact Level SQ  |   |   |

# TEST REPORT

WHC-SD-GN-TRP-30010

Revision 0

## LOAD TEST OF THE 3701U BUILDING ROOF DECK AND SUPPORT STRUCTURE

For Personnel Access Using  
a Remotely Operated Robot

Prepared By: R. M. McCoy Date: 7-21-94  
R. M. McCoy, Senior Engineer  
Structural Assessments

Reviewed By: R. A. Giller Date: 8-1-94  
R. A. Giller, Senior Engineer  
Structural Assessments

Approved By: T. J. Conrads Date: 8/2/94  
T. J. Conrads, Manager  
Structural Assessments

**WESTINGHOUSE HANFORD COMPANY**  
Hanford Operations and Engineering Contractor  
for the Department of Energy

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## 1.0 INTRODUCTION

The 3701U Building roof area was load tested according to the approved load-test procedure, WHC-SD-GN-TP-30015, Revision 1. The 3701U Building is located in the 300 Area of the Hanford Site and has the following characteristics:

- Roof deck - metal decking supported by steel purlins
- Roof membrane - tar and gravel
- Roof slope - flat (<10 deg)
- Roof elevation - height of about 12.5 ft.

The 3701U Building was visited in August 1992 for a visual inspection, but because of insulation an inspection could not be performed. The building was revisited in March 1994 for the purpose of writing this test report. Because the roof could not be inspected, a test was determined to be the best way to qualify the roof for personnel access.

## 2.0 SUMMARY

The 3701U Building roof was load tested according to the approved load-test procedure, WHC-SD-GN-TP-30015, Revision 1; the specific directions of this test report were followed. The test was performed on July 16, 1994, from 8:30 a.m. to 9:00 a.m.

All pre-test approvals and pre-test checklist items were signed off as shown in Sections 3.3, 3.4, and 3.5 below. On the day of the test, the pre-test briefing was held. The pre-test briefing consisted of filling out the pre-test checklist, discussing proper lifting techniques, reviewing the fall-protection plan, reviewing the job hazards analysis, and reviewing the robot travel path.

The load-test results consist of visual observations and the test engineer's conclusions. Visual observations found no adverse conditions such as large deflections or permanent deformations. No deflection measurements were recorded because the tar and gravel on roofs get displaced by the robot tracks; the result is large variations in deflection measurements.

The conclusions are that the roof has been qualified for 500-lb total roof load and that the "No Roof Access" signs can be changed to "Roof Access Restricted" signs as described in section 4.3.



### 3.0 LOAD TEST

#### 3.1 LOAD-TEST RISKS

Roof load tests involve risks. These risks must be addressed and mitigated by the load-test team and the results accepted or rejected by Safety and the building manager before the test begins. The risks associated with the roof load test fall into two categories: personnel injury and building or equipment damage.

Personnel risks are minimized by evacuating and barricading the work areas, testing the procedure steps, and verifying that the risks are acceptable. Test personnel are also protected by procedures that incorporate job hazards analyses and fall-protection evaluations.

The risks to buildings, building equipment, and the robot are much higher than those for personnel and were evaluated on the basis of the following cost-benefit evaluation based on the 25 buildings to be tested initially.

- Roof access is needed for routine maintenance of roof-mounted equipment, roof membrane repair, and re-roofing work.
- The estimated cost of load testing a roof is \$8,000 per building including the cost of the robot, equipment, and test plan development.
- The estimated cost to move roof-mounted equipment to the ground level is more than \$10,000 per building.
- The estimated cost to remove and replace rigid drywall ceilings so that the roof can be inspected rather than tested is more than \$50,000 per building.
- If a robot falls through the roof, the financial losses are the cost of the robot @ \$50,000 and the repair of building equipment @ \$10,000. [Note: Damage to the building is not included because the roof would have to be repaired anyway.]

Possible damage to building, equipment, and robot is a cost-only risk that is mitigated as follows.

- Visual inspections shall be performed to look for deterioration and test feasibility.
- Expensive equipment is removed from the test areas and the areas beneath.
- The roof is evaluated structurally to verify that, as designed, it is adequate to support the robot.
- Testing of roofs that perform poorly, such as pre-cast concrete or gypsum materials, or structurally suspect roofs will be avoided. Testing of these roofs shall be contingent on further cost-benefit analyses.

- Test failures are expected to be localized, e.g., one wheel of the robot punches through the roof membrane. During the test, deflections are monitored so that if a local failure occurs the test can be stopped before the whole robot falls through the roof.
- Thought was given to tethering the robot to anchor points or overhead cranes. However, it would cost an estimated \$10,000 per building (for a total of \$250,000) to secure the \$50,000 robot. Additionally, the sudden snap of the securing cable system or crane boom movement would be more dangerous to the robot operators than letting the robot free fall.
- Visual inspection and load testing of the 2101M Building indicated that deterioration of the metal decking was limited to small areas and occurred in localized flutes. This localized deterioration has had little effect on the strength of the deck.

Deterioration of localized flutes does not provide a means for the robot to fall through the roof deck. The tracks on the robot will prevent it from completely falling through the deck.

### 3.2 TEST PROCEDURE

- The test engineer was designated as R. M. McCoy.
- The 3701U Building roof area was visited for inspection in August 1992; an inspection of the roof could not be performed because of insulation.
- Deflection calculations (Appendix A) indicate a maximum deflection at the point of greatest deflection of 0.91 in. for 1,062 lb.
- The building plan provided in Appendix B indicates the test area, the observation area, the route that the robot will take to get to and from the roof, and the route the robot will take to test the roof.
- The test engineer has prepared this test report and obtained the pre-test approvals indicated in Section 3.3.
- The job hazards analysis appears in Appendix C.
- A fall-protection program appears in Appendix D.
- Pre-job briefing minutes appear in Appendix E.
- The 3701U Building houses personnel on a full-time basis. The interior of the building shall be barricaded off with "CAUTION" tape and posted with "DANGER" signs. The load test will be performed during off-hours.
- The area around the exterior of the building where the load test is being performed shall be barricaded off at ground level with "CAUTION" tape, and all doors leading into the test area shall be posted with "DANGER" signs.
- Observation ladders and platforms are required for this load test.
- The qualified robot operator for this test shall be R. M. McCoy.

- The robot is to be placed on the roof with the use of the scissors lift.
- The robot shall move across the roof following the path specified on the building plan in Appendix B. The first pass shall be made with an unloaded robot (600 lb). The second pass shall be made with the fully loaded robot (1,062 lb).
- The test engineer shall observe the movement of the robot and look for abnormally large or permanent deflections. The test engineer shall base the pass/fail determination on these observed deflections. Failed roof deck and support members shall be considered unsafe to walk on or under, and appropriate safety measures shall be taken by the building manager.
- The robot shall be removed from the roof after this test with the use of a scissors lift.
- The test engineer or building manager shall remove the load-test postings following the test.
- The building manager shall post the building as unsafe, as required, on the basis of the results of the load testing or at the recommendation of Industrial Safety.
- The test engineer shall complete this test report.

**3.3 PRE-TEST APPROVALS, RELEASE TO PROCEED**

Your signature on this form signifies your agreement with this roof deck load-test plan, and with the pre-test checklist items. The load test may proceed anytime within three months of signing this form.

R. M. McCoy / *R. M. McCoy* Date: 6-14-94  
 Test Engineer (Printed/Signature)

T. J. Conrads / *T. J. Conrads* Date: 6-15-94  
 Central Engineering Management (Printed/Signature)

C. M. Hartman / *C. M. Hartman* Date: 6-15-94  
 Industrial Safety (Printed/Signature)

A. K. Sharma / *A. K. Sharma* Date: 7/12/94  
 Quality Assurance (Printed/Signature)

W. H. Hays / *W. H. Hays* Date: 6/22/94  
 Building Manager (Printed/Signature)

**3.4 TEST ENGINEER'S QUALIFICATION**

- Degree or equivalent work experience in structural, civil, or mechanical engineering fields.
- Two years of combined field and analysis experience in the design, evaluation and construction of building structures.
- Experience in the construction materials of the building being tested, e.g., steel concrete, or wood.
- Approval of the engineering manager shall testify to the ability and credentials of the test engineer.

R. M. McCoy / *R. M. McCoy* Date: 6-14-94  
 Test Engineer (Printed/Signature)

T. J. Conrads / *T. J. Conrads* Date: 6-15-94  
 Manager (Printed/Signature)

3.5 PRE-TEST CHECKLIST

| STEP   | SIGNATURE  |        | DATE    |
|--|------------|--------|---------|
| <b>BEFORE THE LOAD TEST IS SCHEDULED:</b>  |            |        |         |
| Verify that an attempt was made to inspect the roof visually, to find deficiencies and to determine the feasibility of making a load test. | R.M. Meloy | Ausham | 6-13-94 |
| Verify that the roof needs to be load tested.  | R.M. Meloy | Ausham | 6-13-94 |
| Determine slope of roof $\leq 25^\circ$ .  | R.M. Meloy | Ausham | 6-13-94 |
| Prepare building roof plan.  | R.M. Meloy | Ausham | 6-13-94 |
| Prepare stress and deflection calculations based on the as-built member strengths.   | R.M. Meloy | Ausham | 6-13-94 |
| Prepare job hazards analysis.  | R.M. Meloy | Ausham | 6-13-94 |
| Prepare fall-protection plan.  | R.M. Meloy | Ausham | 6-13-94 |
| Obtain pre-test approvals.   | R.M. Meloy | Ausham | 7-8-94  |
| Schedule test date.  | R.M. Meloy | Ausham | 7-8-94  |
| Notify Industrial Safety of test date.   | R.M. Meloy | Ausham | 7-8-94  |
| Notify QA of test date.  | R.M. Meloy | Ausham | 7-8-94  |
| <b>DAY BEFORE TEST:</b>  |            |        |         |
| Check robot batteries for full charge.   | R.M. Meloy |        | 7-15-94 |
| Hold pre-job briefing.<br>(May be conducted on the day of the test.)   | R.M. Meloy | Ausham | 7-15-94 |
| <b>ON THE TEST DAY:</b>  |            |        |         |
| Verify that personnel and valuable/critical equipment have been removed from the building below the load-test area.                        | R.M. Meloy | Ausham | 7-16-94 |
| Barricade off and post danger signs in the load-test area.   | R.M. Meloy | Ausham | 7-16-94 |
| De-energize or shut down equipment or switchgears that are installed under or on the roof test area  | R.M. Meloy |        | 7-16-94 |
| Place observation ladders or platforms.  | N/A        |        |         |

## 4.0 RESULTS AND RECOMMENDATIONS

### 4.1 LOAD-TEST DATA

The load-test data consist of the following visual observations by the test crew.

- The control cable and turning of the robot resulted in the gravel on the roof being moved.
- The tar roof membrane under the gravel layer was not damaged.
- No large deflection or permanent deformation of the deck was noted.

### 4.2 QUALIFICATION RESULTS

The loads for this test were 600 lb for the unloaded robot and 1,062 lb for the fully loaded robot. With these loads no large deflections or permanent deformations were noted. Visual observations reported no soft or weak spots in the roof deck.

On the basis of these observations, the roof deck is qualified for limited personnel access. Personnel and equipment should be limited to half of the tested load or about 500 lb on any one area of the roof. For the metal deck, the roof area is defined by the purlin spacing and the width of 2 ft: roughly one person on any 4- by 4-ft area. For the vault, the area is the total roof area.

### 4.3 RECOMMENDATIONS

The roof is qualified for 500 lb of personnel and equipment in each roof area. The "No Roof Access" signs can be changed to one of the following:

- "Roof Access Restricted. See Building Manager for Access."
- "Roof Load Restricted to 500 lb Total."

The roof deck should be load tested at 5-year intervals. This interval is recommended as the maximum inspection interval on the basis of the present condition of the roof. It assumes that the roof is maintained to prevent deterioration from both interior and exterior sources (e.g., roof or steam leaks). The recommended interval should be shortened, should the possibility of deterioration occur (e.g., roof leaks). If the roof is to have regular foot traffic, the load-test interval should be reduced to half of the suggested interval.

5.0 REFERENCES

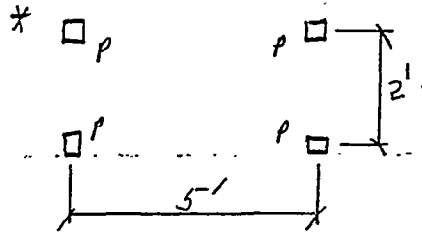
WHC, 1994, *Procedure for the Load Testing of Roof Decks and Support Structures*, WHC-SD-GN-TP-30015, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

**APPENDIX A**  
**STRESS/DEFLECTION CALCULATIONS**



(1) Drawing \_\_\_\_\_ (2) Doc. No. \_\_\_\_\_ (3) Page \_\_\_\_\_ of \_\_\_\_\_  
 (4) Building 3701 U (5) Rev. \_\_\_\_\_ (6) Job No. \_\_\_\_\_  
 (7) Subject \_\_\_\_\_  
 (8) Originator R.M. McCoy Date 6-10-94  
 (9) Checker R.A. Hille Date 6-13-94

- (10) CHECK STRESS FOR MAX. ROBOT LOAD OF 1062#  
ASSUME \* 1062# IS DISTRIBUTED UNIFORMLY TO THE  
 4 CONTACT POINTS (P = 265.5#)



\* SIMPLE SPAN ( $l = 12.0'$ )  
 \* LOAD ACTS OVER  $2'$  <sup>MAX</sup>

REF AISC BM DIAGRAMS #41

DL = DECK = 3.0 PSF  
 INSULATION = 5.0 PSF  
 BUILT-UP ROOF = 6.0 PSF  
 14.4 PSF  $\therefore 14.4(2) = 28.8 \text{ PLF}$

$$M_{MAX} = \frac{P}{2l} \left( l - \frac{a}{2} \right)^2 + \frac{wL^2}{8} \quad a = 2'$$

$$= \frac{265.5}{2(12)} \left( 12 - \frac{2}{2} \right)^2 + \frac{28.8(12)^2}{8}$$

$$\approx 1857 \text{ ft-lb}$$

$$S = .70 \text{ in}^3$$

$$f = \frac{1857(12)}{.7(2)} \approx 15917 \text{ PSI} < 20000 \text{ PSI (PER SDI) } \underline{ok}$$

R 2' WIDTH

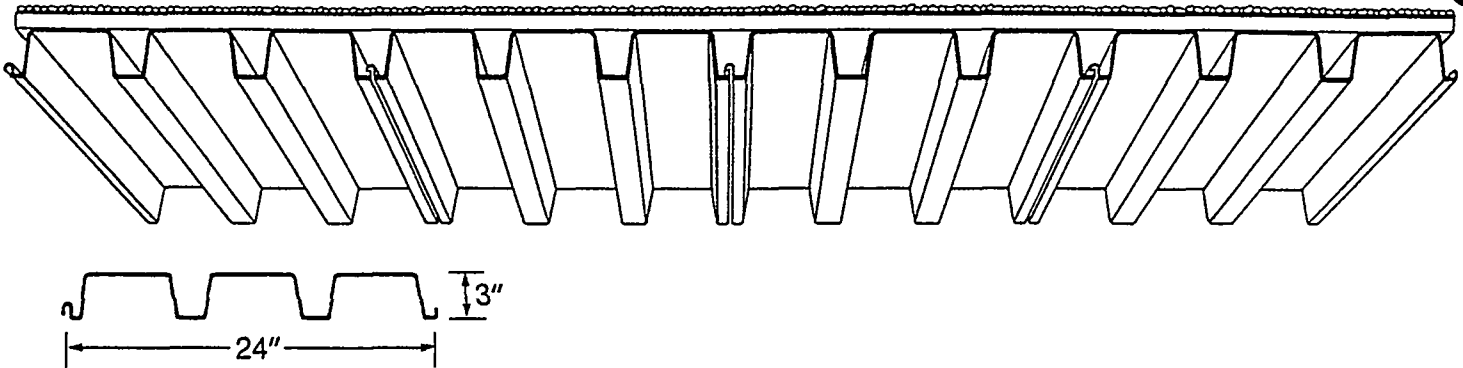
DEFLECTION

$$A_{MAXLL} = \frac{Pa}{24EI} (3l^2 - 4a^2) \quad a = (12-2)/2 = 5' = 60''$$

$$= \frac{265.5(60'')}{24(29E6)(1.20)} [3(144)^2 - 4(60)^2]$$

$$\approx .91''$$

# Type N Roof Deck



Ideally suited to intermediate spans from 10' to 15'. Ribs 8" wide and 3" deep create an attractive fluted pattern for exposed ceilings and canopies. Type N blends with 3"NF Roof Deck and 3"N and 3"NF Acoustideck.

### SECTION PROPERTIES

| Gages     | Weight Duoprimed Lbs./Ft. <sup>2</sup> | Weight Galvanized or Galvanized/Duoprimed Lbs./Ft. <sup>2</sup> | I Moment of Inertia In. <sup>4</sup> | S Section Modulus In. <sup>3</sup> |
|-----------|--|---|--------------------------------------|------------------------------------|
| TYPE 3" N |  |   |                                      |                                    |
| 22        | 2.14                                   | 2.20  | 0.63                                 | 0.37                               |
| 20        | 2.57                                   | 2.64  | 0.81                                 | 0.48                               |
| 18        | 3.43                                   | 3.52  | 1.20                                 | 0.70                               |

### MAXIMUM RECOMMENDED CANTILEVERS

| Live Load         | 30 psf        | 35 psf        | 40 psf        |
|-------------------|---------------|---------------|---------------|
| Dead Load         | 10 psf        | 10 psf        | 10 psf        |
| <b>TOTAL LOAD</b> | <b>40 psf</b> | <b>45 psf</b> | <b>50 psf</b> |
| TYPE 3" N         |               |               |               |
| 22 ga.            | 3'-3"         | 3'-2"         | 2'-10"        |
| 20 ga.            | 3'-7"         | 3'-6"         | 3'-4"         |
| 18 ga.            | 4'-3"         | 4'-2"         | 3'-11"        |

NOTE: See Note 8 on page 4.

PER PROJECT SPEC V647/V653-C1

### SAFE TOTAL LOADS IN POUNDS PER SQUARE FOOT

| Type of Span        | Rib Depth | Gages | Purlin Spacing |     |     |     |     |     |     |  |
|---------------------|-----------|-------|----------------|-----|-----|-----|-----|-----|-----|--|
|                     |           |       | 10'            | 11' | 12' | 13' | 14' | 15' | 16' |  |
| TYPE 3" N           |           |       |                |     |     |     |     |     |     |  |
| Simple Span         | 3"        | 22    | 49             | 40  | 33  |     |     |     |     |  |
|                     |           | 20    | 63             | 50  | 40  | 34  |     |     |     |  |
|                     |           | 18    | 89             | 70  | 56  | 46  | 39  | 34  |     |  |
| Two Spans           | 3"        | 22    | 49             | 40  | 34  |     |     |     |     |  |
|                     |           | 20    | 64             | 52  | 44  | 37  | 32  |     |     |  |
|                     |           | 18    | 93             | 77  | 64  | 55  | 47  | 41  | 36  |  |
| Three or More Spans | 3"        | 22    | 61             | 50  | 42  | 36  | 31  |     |     |  |
|                     |           | 20    | 80             | 66  | 55  | 47  | 40  | 35  | 31  |  |
|                     |           | 18    |                | 96  | 81  | 69  | 58  | 49  | 43  |  |

NOTE See page 4 for Safe Load Table Notes; page 14 for Safe End and Intermediate Reaction Table.

All spans require side-lap fastening at 4'-0" on center.



## SECTION 05300

## METAL DECKING

PART 1 - GENERAL

## 1.01 REFERENCED STANDARDS AND SPECIFICATIONS

The following standards and specifications form a part of this specification to the extent indicated by subsequent references. The documents are of the issue dated below but are referred to thereafter by basic designation only.

## A. Steel Deck Institute (SDI)

1977 Steel Roof Deck Design Manual No. 21

## B. American Welding Society (AWS)

AWS D1.1 Rev. 1-76 Structural Welding Code

## 1.02 SUBMITTALS

A. General submittal requirements: Section 01300.

B. Welding Documents: Welder Certification.

PART 2 - PRODUCTS

## 2.01 METAL DECKING UNITS AND ACCESSORIES

A. Fabricate decking units from zinc-coated steel sheets conforming to SDI, Wide Rib Deck. Use Inryco, Type 3N, 3 inch deep, 18 gauge, as manufactured by Inland Steel Products Co.

B. Furnish decking in lengths which will cover a minimum of two spans of roof support framing wherever possible, allowing for a minimum of 2 inches of bearing on end supports.

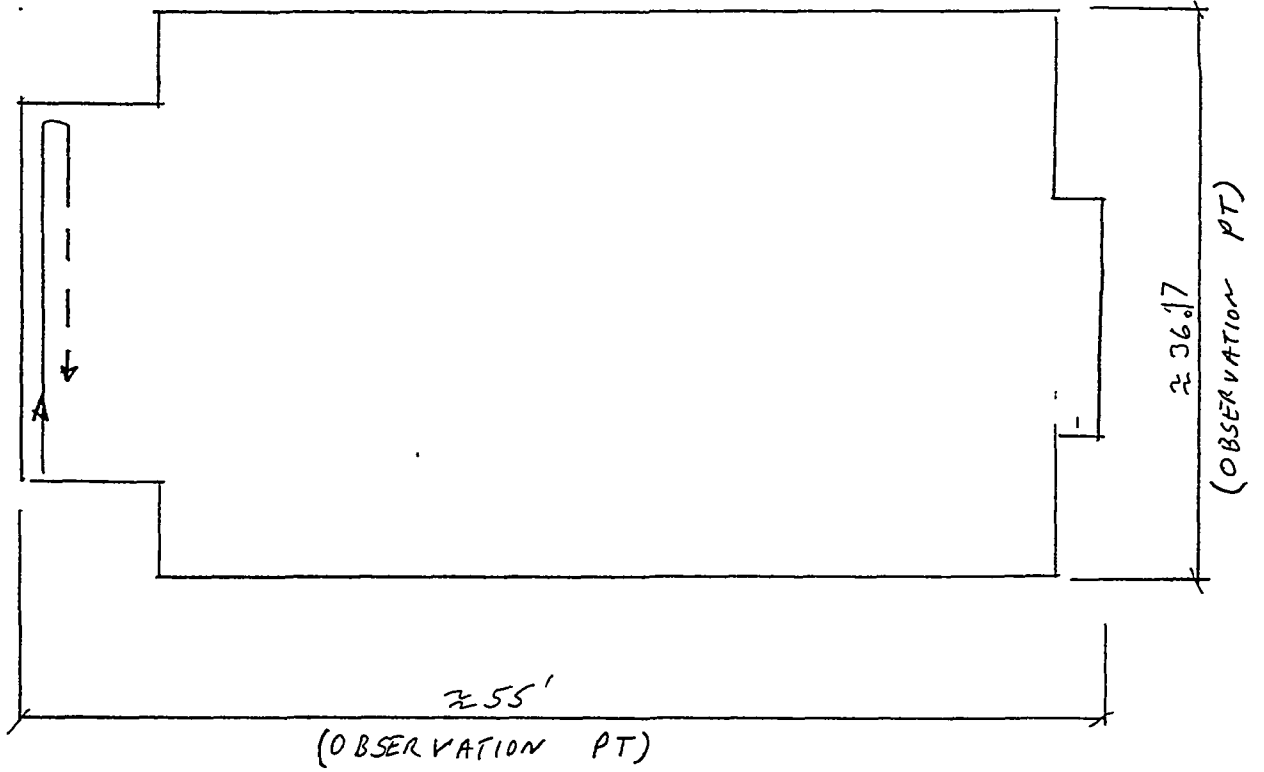
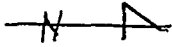
C. Ship decking to the job site in standard widths and cut to proper lengths. All fabrication of penetrations shall be done at the job site.

D. Furnish accessories such as spacer plates, bridging, or other sheet metal items that are to be attached directly to the deck to provide a finished surface for the application of roofing insulation.

E. Use welding washers 16 gauge or heavier, or other approved method, to plug-weld decking to the steel framing to assure continuity of the deck diaphragm at welded laps and joints.

2.02 CLOSERS: Sheet metal or neoprene closers to be the standard product of the decking manufacturer.

**APPENDIX B**  
**BUILDING PLAN**



3701 U BUILDING PLAN  
(LOADED AND UNLOADED)

**APPENDIX C**  
**JOB HAZARDS ANALYSIS**

# HANFORD JOB HAZARD ANALYSIS CHECKLIST

Page 1 of 2

Prepared By **R. M. McCoy** Date **06/07/94** Area **300** Bldg. **3701U**

Scope/Description: **Roof load test of the 3701U Building using a remotely operated robot**

New  
 Revised

Emergency Contact Person(s):

Primary:

Secondary:

Emergency Radio/Phone Number: **MOBIL 811**

JHA Number (not required):

Specific Work Location(s): **3701U Building Roof**

### KNOWN OR POTENTIAL HAZARDS

|                               | Yes | No | ✓ | ● | Reference  |                             | Yes | No | ✓ | ● | Reference  |
|-------------------------------|-----|----|---|---|------------|-----------------------------|-----|----|---|---|------------|
| 1. Radiation Area Work        |     | X  | ✓ | ● |            | 10. Respiratory Hazards     |     | X  | ✓ |   |            |
| 2. Hazardous Waste Operations |     | X  | ✓ | ● |            | 11. Electrical Hazards      |     | X  | ✓ |   |            |
| 3. Confined Space Entry       |     | X  | ✓ | ● |            | 12. Lock and Tag            |     | X  | ✓ | ● |            |
| 4. Cutting/Welding            |     | X  |   | ● |            | 13. Scaffolding             |     | X  |   |   |            |
| 5. Roof Work                  | X   |    |   |   | See page 2 | 14. Aerial Lifts            | X   |    | ✓ |   | See page 2 |
| 6. Fall Hazards (> = 10')     | X   |    |   |   | See page 2 | 15. Asbestos Removal        |     | X  | ✓ | ● |            |
| 7. Excavation/Trenching       |     | X  |   | ● |            | 16. Other (see JHA Sht. 2): |     | X  |   |   |            |

✓ = Formal training required.  
● = Items that require a permit/form/report.

| Other Hazards                       | Yes | No | Control Measures   |
|-------------------------------------|-----|----|--|
| 1. Temperature Extremes             |     | X  |  |
| 2. Noise                            |     | X  |  |
| 3. Poor Lighting                    |     | X  |  |
| 4. Animals/Insects                  |     | X  |  |
| 5. Process Chemicals/Steam          |     | X  |  |
| 6. Dust                             |     | X  |  |
| 7. Flammable/Combustible Materials  |     | X  |  |
| 8. Ladders                          |     | X  |  |
| 9. Wet/Slippery Floors              |     | X  |  |
| 10. Uneven Terrain                  |     | X  |  |
| 11. Open Excavations/Trenches       | X   |    | No roof access in untested areas                             |
| 12. Adjacent Water Hazard           |     | X  |  |
| 13. Vehicle Traffic                 | X   |    | Baracade off work area and post                              |
| 14. Heavy Equipment                 |     | X  |  |
| 15. Rigging Operation               |     | X  |  |
| 16. Manual Lifting                  | X   |    | Manual lifting of weights, see page 2 for control measures   |
| 17. Power Tools                     | X   |    | Robot will be operated by trained and qualified operators    |
| 18. Pinch Points                    | X   |    | See page 2 for control measures                              |
| 19. Falling Objects                 | X   |    | Baracade off work area and post area as no access.           |
| 20. Sharp Objects                   |     | X  |  |
| 21. Overhead Obstructions           |     | X  |  |
| 22. Site Control (Signs/Barricades) | X   |    | "CAUTION" tape & "DANGER" sign will be used to baracade area |
| 23. Remote Work Area                |     | X  |  |
| 24. Other (see JHA Sht. 2):         |     | X  |  |

MINIMUM DRESS REQUIREMENTS: **Dress for outside work / safety shoes / hard hat / safety glasses**

### APPROVALS

Does further evaluation of the job steps, associated hazards, or safety measures need to be performed?  Yes  No  
If Yes, continue job hazard analysis on the following pages.

Supervisor, Person in Charge **R. M. McCoy**

Industrial Safety/Hygiene **C. M. Hartman**

*R. M. McCoy*

*C. M. Hartman*

## HANFORD JOB HAZARD ANALYSIS CHECKLIST

- |                |   |
|----------------|---|
| Roof Work      | Load testing the roof deck and supporting structure will be performed from the roof top.  |
| Fall Hazard    | The fall hazard associated with this task is a property-damage risk and a personnel hazard. See fall-protection program.  |
| Aerial Lift    | The operator of the scissors lift (leased) will have formal training on aerial lifts and review with the supplier of the scissor lift the operations of the scissor lift.   |
| Manual Lifting | Lifting of the robot weights has the potential for back injury.<br><br>Correct lifting methods shall be used, and the robot operators who will be doing the lifting have been trained in these methods during group safety meetings.<br><br>Weights shall be lifted onto the robot only on areas of the roof that have already been qualified by visual inspection. |
| Pinch Points   | The operation of the robot produces pinch points. During the operation of the robot, all personnel shall maintain a minimum distance of 10 ft except for the operators of the robot. The operators shall maintain a distance of 2 ft from the pinch point areas during the robot operations.  |



**APPENDIX D**  
**FALL-PROTECTION PROGRAM**

# FALL-PROTECTION PROGRAM

## PART A: SCISSORS LIFT

A scissors lift will be used to place the robot on and off the roof. When the robot is moved between the scissors lift and the roof, one section of the handrail will be removed. The scissors lift can also be used as an observation platform.

Fall protection will be required. A full body harness with an 8-ft lanyard attached to an approved anchor point on the scissors lift will be used.

Personnel requiring the use of fall-arrest equipment shall be trained and instructed in its use.

## PART B: ROBOT ROOF ACCESS

The fall hazard associated with the robot is loss of property only.

To restrict access to the area under the roof that is being load tested, the following precautions will be used where applicable.

- Lock doors into the test area and post with "DANGER" signs.
- Barricade off the area with "CAUTION" tape and post with "DANGER" signs.

## PART C: PERSONNEL ROOF ACCESS

Personnel and the robot shall be separated by a minimum of one column line, except when the robot is located directly over the ridge beam. The ridge beam is the only place on the roof where the robot, the weights, and test personnel are permitted to be in the same roof area at the same time.

Personnel are to maintain a minimum distance of 6 ft from the edge of the roof. If personnel are required to be within 6 ft of the edge, then an approved fall-arrest system will be used.

## PART D: AERIAL BOOM LIFT

Personnel in an aerial boom lift shall wear full body harness with lanyard attached to an approved anchor point on the lift.

**APPENDIX E**  
**PRE-JOB BRIEFING MINUTES**

Pre-Job Briefing Minutes

Date: 7-16-94  
Building: 3701U BUILDING  
Attendance: R. M. McCoy, J. S. Huisingh

The pre-job briefing meeting was attended by Engineering, Analysis and Technology. The meeting covered the procedure to load-test the 3701U Building.

The following topics were reviewed:

- Risk associated with the load test
- The building plan
- The job hazards analysis
- The fall-protection program
- Safety barricading requirements.

Any additional personnel who come onto the test site must read the 3701U Building test report (WHC-SD-GN-TRP-30010) and review the above topics.

# WORK RELEASE FOR CONSTRUCTION/SERVICE ORGANIZATIONS

|                   |                 |                     |   |                          |                    |
|-------------------|-----------------|---------------------|---|--------------------------|--------------------|
| 1. Date<br>7-8-94 | 2. Shift<br>DAY | 3. Bldg/Area<br>300 | 4. Contractor/Service Org. Point of Contact<br>ROOF TESTING GROUP | 5. Phone No.<br>376-0411 | 6. Job Number<br>— |
|-------------------|-----------------|---------------------|---|--------------------------|--------------------|

7. Job Description

LOAD TEST THE FOLLOWING ROOFS IN ACCORDANCE WITH APPROVED TEST PROCEDURES:

3701D, 3701U, & 3790

8. Support Required (Operator, HPT, others)

NONE

9. Special Requirements (Health, Safety, etc.) for Work Release by Facility Release Authority

IN ACCORDANCE WITH THE APPROVED PROCEDURE

RELEASE APPROVED FROM ~~7-7-94~~ <sup>7-16-94</sup> 7:00 AM TO ~~7-9-94~~ <sup>7-16-94</sup>, 1600

|                            |  |                                     |                     |                    |
|----------------------------|--|-------------------------------------|---------------------|--------------------|
| 10. Lockout Number<br>U.A. | 11. Facility Release Authority (print)<br>Charles P Haggerty | 12. Signature<br><i>[Signature]</i> | 13. Time<br>7:45 AM | 14. Date<br>7/8/94 |
|----------------------------|--|-------------------------------------|---------------------|--------------------|

15. End of Shift Status, including work complete and cleanup (Provide to Release Authority Prior to Shift Change)

|                                       |  |
|---------------------------------------|--|
| 16. Lockout Removed<br>YES [ ] NO [ ] | 17. Facility Owner/Operations End of Shift |
|---------------------------------------|--|

Buff - Field Copy      White - Facility Owner/Operations