ARMED SERVICES BOARD OF CONTRACT APPEALS

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| Appeals of -- | ) | |
| | ) | |
| American Renovation and | ) | |
| Construction Company | ) | ASBCA Nos. 53723, 54038 |
| | ) | |
| Under Contract Nos. F41622-97-C-0022 | ) | |
| F41622-98-C-0011 | ) | |

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OPINION BY ADMINISTRATIVE JUDGE TUNKS

These appeals arose from contracting officer's final decisions revoking acceptance and terminating two design/build contracts for military family housing at Malmstrom Air Force Base (MAFB), Montana, for default. Among other things, the contracting officer (CO) asserted latent defects, breach of the warranty of construction, failure to perform the work in a skillful and workmanlike manner, and failure to deliver the final as-builts as grounds for the terminations. In its amended answers, the government asserted gross mistakes amounting to fraud as an additional basis for the revocations and terminations. American Renovation and Construction Company (ARC) argues that, despite its admittedly defective workmanship, the "root" cause of the deficiencies was the government's specification of slab-on-grade (SOG) construction in an area underlain by fat clay. Alternatively, ARC argues that the revocations were improper because the government had actual knowledge of its non-compliant construction methods. The appeal from the termination of Contract No. F41622-97-C-0022, which included phases I and II (the M2 contract), was docketed as ASBCA No. 53723, and the appeal from the

termination of Contract No. F41622-98-C-0011, which included phase III (the M3 contract), was docketed as ASBCA No. 54038.[1]

Government's Motion for Sanctions

The government requests us to impose sanctions in the form of adverse inferences on ARC for its failure to comply with multiple discovery orders and a subpoena *duces tecum*. We have carefully reviewed the record on the motion, and conclude that sanctions are not warranted except for the adverse inference drawn in finding 204.

## FINDINGS OF FACT

### I. The Site

1. In 1996, the government purchased 90 acres of land adjacent to MAFB on which to build Minuteman Village (MMV), the housing development which is the subject of these appeals (tr. 1/68-70; app. supp. R4, tabs 7, 572 at 16). In connection with the purchase, the government prepared an environmental assessment (EA). The EA indicated that most of the 3,600 acres comprising the base were covered with "lawther silty clays" with low permeability and a high shrink-swell capacity, which were described as poor for construction purposes. (App. supp. R4, tab 563 at 1, 17) The depth to groundwater was estimated to be 100 to 200 feet. Surface water collected in three small wetland areas which affected only the last phase of the development. The area was deleted from the project to avoid any potential problem. (App. supp. R4, tab 572-37, -49). The EA concluded that development of the land would not have a significant impact on the quality of the natural or human environment (*id.* at 37).

2. In 1977, the U.S. Army Corps of Engineers performed a "Foundation Soil Study" (study) at MAFB. The study concluded that "the entire base was underlain with montmorillonitic [expansive or fat] clays with moderate to severe shrink-swell potential, except for the northwest one-third of the base and a small area at its southwest boundary" (app. supp. R4, tab 563 at 5). The study advised against using SOG construction whenever possible, but concluded that it was "more appropriate to provide cost effective designs that accept the possibility of tolerable foundation movements and inconsequential structural

[1] The Rule 4 file in ASBCA No. 53723 consists of tabs 1 through 63. We refer to these documents as "53723, R4, tab __." The Rule 4 file in ASBCA No. 54038 consists of tabs 1 through 71. We refer to these documents as "54038, R4, tab__." The government's supplemental Rule 4 documents are referred to as "R4, tab __." Appellant's documents are referred to as "app. supp. R4, tab __." Altogether, there are about 90,000 documents in paper and electronic form in the record.

defects" when designs "that would eliminate all harmful structure movements [could only be provided] at prohibitive costs" (*id.* at 18, 28-29). The study was not part of either RFP.

3. Fat clay has a strong affinity for moisture (ex. G-44 at 68). The greater the access to moisture, the greater the swell. Due to its low permeability, moisture moves very slowly through fat clay. Each downward movement of moisture wets the layer below, causing swelling. The successive swelling of deeper layers will continue until moisture equilibrium is reached, which is the point at which the downward pressure of the overlying soil equals the upward pressure of the clay. Although residential facilities are typically designed for a live load of 40 pounds per square foot, swelling fat clay can exert upward pressures of 4,000 to 5,000 pounds per square foot. A structure resting on swelling fat clay will continue to heave, perhaps for years, until moisture equilibrium is reached. (R4, tab 147 at 6; tr. 10/70, 72; ex. G-44 at 38, 68-69, 71)

4. Thomas, Dean & Hoskins, Inc. (TD&H), prepared a geotechnical report dated November 1996 for the M2 request for proposals (RFP). TD&H concluded that "[SOG] construction for basement floors may be used, provided the owner is willing to accept the risk of slab movements" (53723, R4, tab 1A, report at 10). TD&H also prepared the geotechnical report for the M3 RFP, which included identical language (54038, R4, tab 3C at 10). Maxim Technologies, Inc. (Maxim), prepared the geotechnical report for the design phase of the M3 contract and concluded that "[SOG] construction may be used if suitable precautions are followed, and provided the risk of distress resulting from slab movement is accepted by the owner" (R4, tab 147 at 10). In order to minimize slab movement, both firms recommended that a "floating slab" be used (53723, R4, tab 1A, report at 14, 54038, R4, tab 3C at 14, R4 tab 147 at 11).

5. A SOG is a concrete slab that is cast directly on the soil and is supported by the soil. Typically, a SOG is 4-inches thick and lightly reinforced with steel bars. (Tr. 6/121, 10/63-65) A floating slab is a SOG that is structurally isolated or separated from bearing walls and columns with expansion joint material, allowing unrestricted vertical movement (53723, R4, tab 1A, report at 14, R4, tab 147 at 11). A structural floor system requires a slightly deeper excavation, which is used to create a buffer of 8 to 12 inches between the structural concrete floor and the soil. As a result, when the soil settles or heaves, the slab will not be affected. A structural floor system requires a more complex foundation system than a SOG. While a SOG is supported by the soil, a structural floor system is supported by a foundation that spans between grade beams that are supported by deep foundation elements. Where fat clay is present, the foundation must be deep enough so that the soil is volumetrically stable. (Tr. 10/64-66)

6. SOG construction with basements is the norm for residential housing in the Great Falls area. Mr. Erling A. Juel, who co-authored the TD&H report for the M2 contract, is a geotechnical engineer and has lived in the Great Falls area for 12½ years.

He testified that "[i]t's very normal in Great Falls to do SOG construction or to utilize basements with [SOG] for residential construction [because] it's cost prohibitive to do anything otherwise" (tr. 6/62). Mr. Michael W. Lee, ARC's structural engineering expert, agreed that it would be significantly more costly to select a structural floor system than a SOG in an area of expansive soils (tr. 10/76-79). Mr. David Zahller, the co-author of the TD&H report, is a structural engineer and has lived in the Great Falls area for 24 years. He testified that "almost every residence in Great Falls, has a [SOG] with a basement, and the vast majority of them do very well." He could not "think of any residential [sic] in Great Falls that has a structural floor system." (Ex. G-9, Zahller dep. at 200; tr. 5/220, 226-27) Mr. Peter J. Klevberg, who was employed by Maxim Technologies, Inc. (Maxim), was ARC's soils engineer for both contracts. He has lived in the Great Falls area for 13 years and testified that SOG construction was "typical" in the area (tr. 5/145; ex. G-9, Klevberg dep. at 359-60).

7. There are 1,406 houses on MAFB, most of which are "Capehart" houses built in the late fifties and early sixties (tr. 1/57-1/61). The drawings and specifications for the houses are not in evidence; however, the parties agree that the houses have SOG construction with basements (app. br. at proposed finding of facts 19, 20; tr. 1/71, 9/273-74). Mr. William J. McLaughlin, Chief Engineer Flight for the MAFB Civil Engineering Squadron has worked at the base for 15 years (tr. 1/55). He testified that the houses had "performed well," but that some of the slabs in the older units began exhibiting minor heave on the order of 1 to 1 1/2 inches about 15 years after they were built (tr. 1/55-57, 71). Mr. Jack Gamble, the base project manager/civil engineer, has worked at MAFB for 37 years (tr. 9/204-05). He first observed heaving in the basements in the mid-seventies. He testified that "the worst case was probably four inches...and [e]ach year we would have a small repair project that would probably involve, you know, it could have been 40 units, 30, 40 units, possibly." (Tr. 9/274)

II. M2 RFP

8. On 21 February 1997, the government issued RFP No. F41622-97-R-0017. The RFP included 35 percent drawings and 100 percent specifications prepared by Schooley, Caldwell Associates (SCA), and the November 1996 geotechnical report prepared by TD&H (53723, R4, tab 1A). The construction cost limit (CCL) was $14,354,000 (app. supp. R4, tab 7). On 11 April 1997, the government issued revised specification pages dated 28 March 1997 by Amendment No. 0002 (53723, R4, tab 2A).

9. TD&H drilled 30 holes to depths of 15 to 20 feet and took soil samples for laboratory testing. Fat clay was encountered in all holes at .5 to approximately 6.5 feet. The average depth to fat clay was 3.8 feet. No groundwater was encountered during drilling. TD&H advised that groundwater near the base was usually confined in sand

seams and layers. Based on the borings, however, it did not expect that groundwater would be encountered during construction. (53723, R4, tab 1A, report at 7, 8)

10. TD&H concluded that the "primary geotechnical concern regarding th[e] project [was] the presence of...fat clay [at] foundation grade" (53723, R4, tab 1A, report at 8). TD&H recommended that (1) all fill and backfill be nonexpansive; (2) fill and backfill be placed in uniform lifts not exceeding 8 inches; (3) lifts be compacted to 95 percent of the maximum dry density per ASTM D-1557; (4) positive site grades be developed and maintained in order to rapidly drain surface water and runoff away from the foundation and subgrade; (5) soils disturbed below the planned depths of footing excavations be recompacted or replaced with suitable compacted backfill; (6) backfill against the sides of the footings and the base of the walls be compacted to 98 percent of the maximum dry density per ASTM D-1557; (7) exterior footing drains be installed; (8) polyethylene sheeting be placed below the finished exterior grade; (9) floor slabs be structurally isolated to allow unrestrained vertical movement; and (10) interior non-bearing walls have slip joints to prevent transmission of slab movements to the upper structure. If the government was unwilling to accept the risk of movement, TD&H recommended that a structural floor system be used. (53723, R4, tab 1A, report at 12-14)

11. At the request of the government, NTL Engineering & Geoscience, Inc. (NTL) installed two groundwater monitoring piezometers at the site of the M2 contract. On 11 April 1997, piezometer OW-1 was dry and piezometer OW-2 had water within 1 foot of the surface. On 17 April 1997, OW-1 was dry and the water level in piezometer OW-2 was about 3.6 feet below the ground surface (bgs). (App. supp. R4, tabs 608, 609, 614, 617) TD&H was apprised of NTL's findings and affirmed its report. Base personnel still felt strongly that perched water would be found in some or many of the silty, sand lenses (app. supp. R4, tab 615). As a result, the following language was added to paragraph 3.05F. of the earthwork specification via Amendment No. 0004 dated 16 June 1997:

> Perched water in sandy, silty soils may be encountered at lower elevations on the site. Where saturated fat clays are found in the building footing or utility trench areas, excavate saturated material and backfill with compacted stabilized material or lean mix concrete as directed by the Soils Engineer and Contracting Officer.

(App. supp. R4, tab 616; *see* 53723 R4, tab 1A, spec. § 02200, ¶¶ 3.05F, 3.07C)

12. Relying on the TD&H report, the SCA drawings and specifications called out SOG construction with full basements. The RFP also required straw-filled augured holes, visqueen vapor barriers, interior and exterior drain tiles, and waterproofing. (53723 R4,

tab 1A at drawings A01, A05, A10; tab 2A, spec. § 02200, ¶ 3.05M) Fill next to the foundation walls was to be nonexpansive and compacted to 95 percent of the maximum dry density of ASTM D 698 (*id.*, § 02200, ¶¶ 2.01, 3.09B). According to ¶ 2.2 of specification § 01002, the successful offeror would "be required to complete the design...and construct the project in compliance with these requirements" (53723, R4, tab 2A).

13. The government received two proposals, neither of which allowed for award of the full quantity within the CCL. On 5 May 1997, the government extended the closing date of the RFP indefinitely. (App. supp. R4, tab 9 at 3, 10) Although Mr. Dethloff, ARC's vice president (later its president), reviewed the RFP and conducted a site visit, he did not submit a proposal (tr. 5/59-60).

III. Amendment No. A0004/CCL

14. On 5 May 1997, the CO solicited suggestions from prospective offerors to bring the cost of the contract within the CCL without deleting any units (app. supp. R4, tab 625). In addition to changes to other aspects of the work, the offerors suggested that the earthwork specification be rewritten to define fat clay as satisfactory material, that the compaction requirements be decreased, and that the amount of select backfill required for the project be reduced (app. supp. R4, tab 631). As one contractor stated, the cost of providing the amount of select backfill required by the original specification "would be enormous" (*id*. at 9).

15. The government issued Amendment No. A0004 to the RFP on 16 June 1997. Among other things, the earthwork specification was changed as follows:

> (1) Fat clay (CH) was redefined as satisfactory material except next to foundation walls;
>
> (2) The compaction requirement for backfill against the sides of the footings and the base of the walls was reduced to 92%;
>
> (3) The requirement for six-foot foundation supports under stoops and porches was deleted;
>
> (4) The requirement for straw-fill augured holes under the floor slabs was deleted;
>
> (5) The requirement for an interior perimeter foundation drain was deleted;

(6) The requirement for waterproofing was changed to "dampproofing;"

(7) The requirement for 10 mil polyethylene sheeting under the units was deleted.

(R4, tab 2A, A0004 at 5, 10 of 12 and spec. § 02200, ¶¶ 2.01, 3.05M, 3.09B; app. supp. R4, tab 1465 at plates 4, 5, 8, 9, 15)

16. After issuance of Amendment No. A0004, Mr. Dethloff conducted a second site visit. He observed a wheat field without "water, mud, rock, any type of that material." (Tr. 7/67)

IV. M2 Contract

17. On 26 September 1997, the Air Force Center for Environmental Excellence (AFCEE) at Brooks Air Force Base, Texas, awarded Contract No. F41622-97-C-0022 to ARC in the amount of $14,359,380.[2] The contract was a design/build contract requiring the construction of 122 duplex and single family housing units contained in 69 buildings. (App. supp. R4, tabs 6, 10, 15)

18. The contract incorporated by reference FAR 52.236-5, MATERIAL AND WORKMANSHIP (APR 1984); FAR 52.246-12, INSPECTION OF CONSTRUCTION (AUG 1986[3]); FAR 52.246-21, WARRANTY OF CONSTRUCTION (MAR 1994); and FAR 52.249-10, DEFAULT (FIXED-PRICE CONSTRUCTION) (APR 1984) (53723, R4, tab 1A at 13, 21, 22 of 59). The Inspection of Construction clause provided, in part, as follows:

> (b) The Contractor shall maintain an adequate inspection system and perform such inspections as will ensure that the work performed...conforms to contract requirements. The Contractor shall maintain complete inspection records and make them available to the Government....

[2] After award of the M2 contract, ARC notified the government that it had entered into a joint venture agreement with Soltek Pacific, Inc. (Soltek) (R4, tab 902). Modification No. P00001 changed the name of the contractor to "American Renovation & Construction Company/Soltek Pacific" (ASBCA No. 53723 (53723), R4, tab 7). Although the M3 contract was awarded to ARC in its own name, the contract identified both ARC and Soltek as payees. Soltek was removed as a payee shortly after award (ASBCA No. 54038 (54038), R4, tab 1 at 12 of 30, tab 5 at P00001). We refer to the contractor for both contracts as ARC.

[3] The correct date of the clause appears to be August 1996.

> (c) Government inspections and tests are for the sole benefit of the Government and do not—
>
> (1) Relieve the Contractor of responsibility for providing adequate quality control measures;
>
> ....
>
> (d) The presence or absence of a Government inspector does not relieve the Contractor from any contract requirement, nor is the inspector authorized to change any term or condition of the specification without the [CO's] written authorization.
>
> ....
>
> (f) The Contractor shall, without charge, replace or correct work found...not to conform to contract requirements....
>
> (g) If the Contractor does not promptly replace or correct rejected work, the Government may (1) by contract or otherwise, replace or correct the work and charge the cost to the Contractor or (2) terminate for default the Contractor's right to proceed.
>
> ....
>
> (i) [T]he Government shall accept, as promptly as practicable after completion and inspection, all work required by the contract.... Acceptance shall be final and conclusive except for latent defects, fraud, gross mistakes amounting to fraud, or the Government's rights under any warranty or guarantee.

The Warranty of Construction clause provides for a warranty "for a period of 1 year from the date of final acceptance of the work," or, if the government has taken possession of any part of the work, for a period of one year from the date of possession.

19. The contract included 35 percent drawings and 100 percent specifications and called out four-inch concrete floor slabs with full basements (53723, R4, tab 1A at

drawing A01, tab 2A, spec. § 02200, ¶ 3.10). Although Mr. Dethloff testified that the drawings were 70 percent complete, the drawing package did not include any structural drawings (including engineering calculations), mechanical drawings, or plumbing drawings. In addition, it appears that ARC may have expanded the architectural drawings during the design review process. (53723, R4, tab 1A at drawing T01; tr. 7/65)

20. Edward J. Cass Associates (EJCA) signed and sealed the drawings on 8 May 1998 (53723, R4, tabs 4, 5). EJCA's drawings called out four-inch floor slabs on grade with #3 rebar at 18 inches on center and full basements (53723, R4, tab 5 at drawing S2.1). The basements were supported by trench footings that extended from 7 to 10 feet bgs. The garage footings extended approximately six feet bgs, were rigidly attached to the buildings, and filled with compacted fill up to the level of the subgrade. Each unit had a bearing beam in the center to support the first floor. The bearing beam was supported by interior adjustable steel post jacks bearing on isolated spread footings. An exterior perimeter foundation drain (PFD) was located at the top of the footings. The basement stairway was connected directly to the basement floor slab and ¾-inch Simpson clips were installed at the top of the basement walls. The drawings required that positive drainage be maintained.

21. Specification section "01000 GENERAL REQUIREMENTS" contained the following relevant provisions. Paragraph 3.03C required that the final as-built drawings be submitted within 30 calendar days of the final inspection. Paragraph 3.04 required that "[a]ll items of concealed work...be Government inspected prior to concealment." Paragraph 3.10 required that all discrepancies found during the prefinal inspection be corrected prior to the final inspection. Paragraph 3.16 provided as follows:

> **3.16 QUALITY CONTROL**
>
> A. ... THE CONTRACTOR IS RESPONSIBLE FOR QUALITY CONTROL WHICH IS CONSIDERED BY THE GOVERNMENT TO BE A MAJOR INSPECTABLE ITEM OF THIS CONTRACT.... [Emphasis in original]
>
> B. ...Prior to the start of construction, the Quality Control Plan [QC plan] must be accepted by the Government....
>
> ....
>
> C. ... Non-compliance with the [QC plan] will result in appropriate action by the CO.

(53723, R4, tab 1A)

22. ARC's approved QC plan set forth the following testing plan for in-place moisture and density testing:

> ONE TEST EACH 2000 SQUARE FEET OF EACH 8 INCH LIFT, AND AS REQUIRED TO VERIFY PROPER BACKFILLING OF STRUCTURES AND CONFINED AREAS. EACH LAYER AND SUBGRADE, MIN. 2 TESTS.

(R4, tab 910 at 1.31)

23. Specification section 01002 "DESIGN-BUILD PROJECT REQUIREMENTS" contained the following relevant provisions. Paragraph 2.1 designated the contractor as the "Architect/Engineer of Record." Paragraph 2.2 required the contractor to complete the design and construct the project in compliance with the approved drawings and specifications. Paragraph 3.5F. required the contractor to submit one copy of its QC report to the CO and one copy to the inspector by noon of the next workday following the day of the report. (53723, R4, tab 1A)

24. Specification 01450 **"**QUALITY CONTROL" provided, in part, as follows:

> **1.08 EARTHWORK FIELD OBSERVATION AND TESTING**
>
> A. An independent testing laboratory...shall be retained...to perform all testing and observation for earthwork....
>
> ....
>
> C. Observed or tested items that indicate non-compliance... shall be documented and immediately brought to the attention of the [CO]....
>
> D. The Contractor shall...provide easy access for personnel to all areas to be tested....
>
> E. Employment of testing laboratory shall in no way relieve the Contractor of his obligation to perform work in accordance with the Contract Documents.

F. Test Frequency: The frequency of tests shall be sufficient to ensure reasonable coverage of the work.... As a minimum, the following test frequency shall be implemented:

| Earthwork | Frequency |
|---|---|
| 1. Compaction Testing. | A Soils Engineer to observe...and perform density testing. |
| 2. Determine suitability of soil.... | As required. |
| 3. Perform laboratory moisture-density relationship curve (proctor).... | Each proposed fill material. |
| 4. In-place density and moisture content. | One test per 2,000 square feet of each 8 inch lift, plus as required to verify proper backfilling of structures and confined areas. This frequency to include utility trenches. |
| .... | |
| 6. Foundations. | [A Soils] Engineer to observe bottom of footing excavations... and verify suitability of bearing soils.... |
| 7. Pipe Trenches. | A Soils Engineer...to observe trench excavation and backfill.... |

G. Test Reports: Promptly submit reports of each day's inspections and tests including:

....

11. Observations regarding compliance with Contract Documents...shall be made directly to the [CO] with copies to the Contractor.

(53723, R4, tab 1A)

25. Specification section 02200 “EARTHWORK” provided, in part, as follows:

**1.07**[E.] Dewatering:

1. Provide dewatering...as required....

2. [Water] shall not be permitted to collect and stand in excavations. Soils softened by moisture or standing water shall be removed...before concrete or earth fill is placed.

....

**2.01 SATISFACTORY FILL MATERIALS**

A. Satisfactory fill materials shall consist of clean, non-organic site or imported soil that will achieve an in-place dry weight density in excess of 105 pounds per cubic foot and contain no topsoil, stones larger than 3 inches, organic matter or debris. Materials shall be as classified in ASTM D 2487-85 as GW, GP, SW, SP, SM, GM, GC, SC, CH [fat clay] and CL properly worked...to obtain optimum moisture and compaction....

B. Backfill for foundation walls shall be nonexpansive soils with liquid limits of 27 to 49 percent and plasticity indexes of 4 to 30 percent. The natural moisture content may be from 9 to 23 percent and an average 14 percent.

**2.02 UNSATISFACTORY MATERIAL**

A. Unsatisfactory materials for fill construction and for subgrade under structures, piping, or paving include materials classified in ASTM D 2487 as PT, NL, OH, MH, and OL, topsoil or other organic contaminated material, debris, and rocks over 3 inches....

....

**3.03 EXCAVATION – GENERAL**

A. All excavating required for the installation of piped utilities, foundations, subgrades, and bases shall be performed to the required depths as shown on the drawings and/or specified....

C. Stockpile subgrade separately from topsoil.

D. Excavate only to depths shown. Excess excavation not ordered is to be replaced...at the Contractor's expense.

**3.04 EMBANKMENT – GENERAL**

....

B. Place fill in loose layers not to exceed 8 inches in loose depth. Compact each layer of fill to the percentages of density as specified in this Section.

....

D. ... Fill material containing excess moisture shall be permitted to dry to the proper consistency before being compacted.

E. Frozen material shall not be placed in the fill....

**3.05 EXCAVATION AND BACKFILLING FOR STRUCTURES**

....

C. Provide excavation to depths as shown on the plans and as required for proper installation of footings.

....

E. Footing excavations shall be cut to a flat bottom with the bottom comprised of [undisturbed] firm soil....

F. Excavations for footings shall be inspected during construction and immediately prior to placement of concrete. Where suitable bearing is not encountered at planned footing

elevations, the footings shall be undercut as directed by Soil Engineer and [CO] to suitable bearing and backfilled to proper elevation with lean mix concrete (1,500 psi).... Perched water in sandy, silty soils may be encountered at lower elevation[s].... Where saturated fat clays are found in the building footing or utility trench areas, excavate saturated material and backfill with compacted stabilized material...as directed by the Soils Engineer....

I. Place backfill in loose layers not to exceed 8 inches and compact each lift to the density specified in this section.

....

**3.09 COMPACTION REQUIREMENTS AND TESTING**

A. Excavation of unsuitable material, ...preparation of subgrade bearing surfaces, placement of controlled fill, and compaction of subgrade surfaces shall be under the full-time supervision of the Soil Engineer and/or [CO] as per Section 01450 – Quality Control.

B. Compact soil materials to the maximum dry density as per ASTM D 698 as follows:

1. Subgrade compaction – 95 percent.
2. Backfill for structures.
    a. Earth backfill – 95 percent.
    b. Granular Backfill – 98 percent.
    c. Earth backfill around basement walls – 92 percent.
3. Backfill for trenches - 98 percent – Under pavements and structures; 92 percent – Under open field.

(App. supp. R4, tab 6)

26. At award, the contracting officer (CO) was Mr. Paul J. Vaughn and the contract administrator was Ms. Rebecca Rounsavill. They were part of the 311th Human Systems Wing at Brooks AFB, Texas, which provided contract services to "customers," including the Air Force Space Command of which MAFB was a part (ex. A-4 at 98, ex. 60, ex. A-6 at 11-12). Ms. Rounsavill succeeded Mr. Vaughn as CO on 26 February 1999 and issued both termination decisions.

27. AFCEE provided technical assistance to the CO. Capt Robert J. Cantwell was the initial contracting officer's technical representative or project manager (COTR or PM). Capt Michael D. Miller succeeded him on 1 January 1999. Mr. David Cole took over in September 2000 and remained in that position through both terminations. The PM represented the CO in the field and managed the contract. Ms. Rounsavill expected contract noncompliances to be reported to the PM. If the PM was not available, noncompliances could be reported directly to her. As she put it at the hearing: "[i]f the [PM] can handle it and resolve the issue without having to come to me, then so be it. That's why I delegate it to where he can handle some of these actions in the field." (Tr. 2/144-48) The PM was also responsible for managing the Title II inspectors. Capt Miller testified that they were his "eyes and ears" and that he expected them to inform him of noncompliances "any time, any fashion" so that they could be addressed with the contractor and, if necessary, with the CO (ex. A-6 at 38-39).

28. The government hired Hellmuth, Obata & Kassabaum, Inc. (HOK) to provide "Title II" services. HOK subcontracted the work to L'Heureux Page Werner, P.C. (LPW). Mr. Ronald LaRue was the primary LPW inspector and Mr. Gregory McMahon was his assistant. (App. supp. R4, tab 714) The HOK statement of work (SOW) required the inspectors to "report to and work through" the PM. Their job was to inspect the work and report noncompliances in writing to the PM and the CO. Absent authorization from the CO, they could not (1) grant deviations; (2) advise or issue directions regarding construction means, methods, or procedures; or (3) issue interpretations or clarifications directly to the contractor. (App. supp. R4, tab 16, ¶¶ 1.3, 1.5, 4)

29. Maxim was ARC's independent testing laboratory and Mr. Klevberg was the soils engineer for both contracts (tr. 5/84). Mr. William Jones was the primary testing technician and Mr. Henry Sivumaki assisted him as needed (tr. 5/89). Mr. David Carlin was Soltek's "[o]perations manager" for both contracts (tr. 5/6).

## V. PERFORMANCE OF THE M2 CONTRACT

30. Work began on at the site on or about 3 April 1998 (R4, tab 843-13).

### A. Satisfactory Material

31. At the start of the work, Mr. Klevberg advised ARC that certain soil types, particularly sand and clay, should not be mixed during excavation and backfilling of utility trenches. He explained that mixing soil types alters the proportions of the various types of soil particles, changing their engineering properties and requiring the creation of unnecessary Proctor tests. He also stated that heterogeneous mixtures of soil types make it difficult to achieve compaction. (R4, tab 141; tr. 5/93-95). At the hearing, he testified that the foregoing advice applied "to pretty much any backfilling in the project" (tr. 5/95).

32. Mr. Klevberg testified that ARC did not segregate soils during excavation:

> Q What is the purpose of the creation of a stockpile?
>
> A To get the [s]oil out of the way until it's needed.
>
> Q [Are] the stockpiles...segregated by soil type?
>
> A Yes.
>
> Q Is that normal practice?
>
> A It's good practice.
>
> Q It's good practice. Is it normal practice?
>
> A If by normal you mean most contractors do it, no. If by normal you mean that there's a substantial number of contractors that do...on a substantial number of projects, yes.
>
> Q Do you know if the soil stockpiles in this case were segregated by soil type?
>
> A They were not.

(Ex. G-9, Klevberg dep. at 101-02)

33. Mr. McMahon, the assistant Title II inspector, also testified that ARC did not segregate excavated materials (tr. 9/115-16).

34. Mr. Gauvin, ARC's foreman for most of the project, supervised ARC's in-house labor force. The in-house labor force backfilled and compacted around the foundations (tr. 8/32). Mr. Gauvin testified that "[his] segregation" consisted of "try[ing] to put the bigger stuff to the side and using the smoother soil to backfill with" (tr. 8/49).

35. Mr. Jay Nelson, principal of J&K Excavating, ARC's earthwork subcontractor, testified that ARC did not segregate the soils used for backfill and compaction, that "they "pushed [in] whatever was closest to the building" (tr. 3/183).

36. On 29 July 1998, Mr. LaRue and Mr. McMahon advised ARC that "[i]t is imperative we are kept abreast of items to be inspected. We need to receive a schedule of

activity daily. There are currently four basements that were not inspected prior to concrete placement." (R4, tab 846-26)

37. On 6 August 1998, Mr. Magyar, ARC's superintendent, noted the following:

> Bill [Dombrouski[4]] of Maxim…said he was concerned about the material not being segregated, that there was 2' dia. clay balls being sloffed [sic] into holes, along w/silty sand materials.

(R4, tab 836-01)

38. Mr. Jones noted the following on his project report for 4 August 1998:

> 755 am: Arrived on site, the concrete placement of floor slab for unit 7100 almost completed. No test sample taken from this placement; nor were there any sub slab densities test[s] [taken]. Never was notified of this placement.
>
> ....
>
> -I noticed 2' diameter soil clog at FTG subgrade and next to foundation wall of unit 7068. I advised [ARC] that dirt clog need[ed] to be broken before backfilling gets too far along. I expressed my concern for the large voids in the backfill area. This area is also beneath the front door stoops.

(R4, tab 327)

39. Mr. Jones testified that the clods pointed out to ARC at unit 7068 were too dry to compact and that left in the backfill they would result in "a lot of voids in the soils." He also testified that there were clods at "more than one unit" in that area (tr. 3/56-57).

40. On his 7 August 1998 project report, Mr. Jones reported the following:

> Unit 7068 had considerable dirt clods measuring 2' to 3' diameter abutting the foundation wall. This creates large

[4] Mr. Dombrouski is a geotechnical engineer employed by Maxim (tr. 189).

> subsurface voids with eventual sinking of surface grades as the surrounding soils migrate to fill the void.
>
> > --There are other units with dirt clods measuring 1'...that might [cause] future settling. Especially next to foundation where tamping efforts are restricted.

(R4, tab 330 at 7)

41. On his project report for 30 September 1998, Mr. Sivumaki noted that the fill placed at the garage of unit 7087 and the driveway slab of unit 7080 contained topsoil as well as straw and debris (R4, tab 374 at 8).

42. On 9 December 1998, Mr. Kraybill, ARC's QC manager, reported that large clods of earth were being placed in the backfill at units 7041, 7043, and 7045:

> Typical[ly] there are "clods" larger than 12" being used (some 18") as backfill against[the] unit. [This is] likely to cause settling at [a] later date, which in turn could le[a]d to drainage toward rather than away from [the] unit. [Clods are] typical in many areas as the material is a very tight clay...that tends to clod in large pieces.

(R4, tab 1145)

43. On 28 December 1998, Mr. Kraybill noted as follows:

> [O]bserved 2 bobcat loaders working front of 74 & 76. The one at 74 dumped some icy stuff on garage side Bkfill. Told Jay [Olson, ARC's PM]—he kind of blew me off....

(R4, tab 1159)

44. In January/February 1999, Mr. Kraybill observed ARC placing chunks of dirty ice mixed with frozen soil against the outside wall of a basement. The icy material ranged in size from 8 inches to 2 feet in diameter. (Ex. G-9, Kraybill dep. at 50-52, 91)

45. In his project report for 10 June 1999, Mr. Jones noted that topsoil and subgrade were being mixed at units 7056 and 7058 (R4, tab 566 at 5).

46. On 21 June 1999, Mr. Jones reported that the materials being used to fill the stoop at unit 7068 were mixed with organic matter (R4 tab 575 at 3).

47. Mr. Nelson observed ARC placing clumps of dirt that were eight to twelve inches in diameter in the backfill against the foundation wall. In some places, he saw clumps as big as two to three feet in diameter. (R4, tab 831-40, -43; tr. 3/164-72) Mr. Nelson also saw ARC use soil from stockpiles strewn with debris as backfill (R4, tab 831-55; tr. 3/176-77).

48. In October 2003, the government repaired 15 units as part of a Pilot Repair Project (PRP). The units were demolished to the foundations and rebuilt. During the demolition, the government discovered a wooden fence post, 2 x 8 pieces of lumber, and steel stakes buried in the backfill. (R4, tab 1115(3)-(5))

49. When asked if he observed ARC using fat clay as backfill adjacent to the foundations, Mr. McMahon testified that he thought he did, but that he was unable to verify that suspicion. During his deposition, however, he testified that he observed fat clay being placed adjacent to the foundations 50 percent of the time. He explained the discrepancy in his answers as follows:

> I somewhat changed my opinion as to the fat clay being used, because visually it's very difficult to determine if fat clay was used.
>
> ….
>
> The reason I believed [that fat clay was being used] was [because] the soil testing and the original geotechnical reports [indicated] there was a certain amount of fat clay in the soil.
>
> [Since] there was no great deal of segregation of material [and] no excavated material [was] hauled off the site[,] [I concluded that] there was a certain percentage of fat clay being used in the backfill.

(Tr. 9/116-18)

B. Overexcavation

50. The specification required that a soils engineer observe the bottom of each footing excavation prior to pouring concrete. Mr. Klevberg testified that this requirement caused the following problem:

> [It] was something of a sore point with [ARC] because I had to be available. They had to notify me. I had to go out and examine th[e] [excavations] before they could proceed...and so the construction was delayed until I could render an opinion....
>
> So, their intention...was [to] just routinely go in, [over]excavate [,] put in some granular fill and continue on without having to wait for anyone to come look at it.

(Tr. 5/111-12)

51. On 4 June 1998, Mr. Klevberg advised ARC that it could routinely overexcavate footing trenches by approximately one foot and replace the excavated material with structural fill compacted to 98 percent of ASTM D 698. Alternatively, he suggested using lean mix (1,500 psi) concrete. (R4, tab 140)

52. Where saturated fat clays were found in the footings or utility trenches, the specification allowed overexcavation as directed by the soils engineer and replacement with "compacted stabilized material" or lean mix concrete. The specification did not define compacted stabilized material. Although Mr. Klevberg recommended that ARC use gravel to replace the excavated materials, at the hearing he testified he was unsure of whether gravel constituted "compacted stabilized material:"

> Q. [W]hy do you say that?
>
> A. Well, there is some area of doubt in that. I'm not sure what they mean by "stabilized".
>
> I infer that to mean that it's nonreactive; that it's not something that's going to be affected by placement of concrete or by water or other substances it might encounter.
>
> Compacted would be right in line with the material compaction specification, so we would have to achieve the same degrees of compaction with that material that we would with any other kind of material.
>
> Stabilized might also refer not only to chemical activity but to moisture sensitivity. And I would interpret any moisture-sensitive soil as being unacceptable for that.

(Tr. 5/148)

53. On 24 June 1998, Mr. Jeremiah B. Bowser, Maxim's engineering manager, wrote ARC as follows:

> We understand that [TD&H] has approved the use of crushed aggregate base course and ¾" concrete aggregate [gravel] as compacted backfill beneath the footings….
>
> …[Gravel] is cohesionless and cannot be tested in accordance with ASTM D 698. [Use of gravel fill to replace excavated materials] will...require modifying the...specifications for compaction [as follows]:

| ASTM D698 | ASTM D4253 & D4254 |
|---|---|
| 95% | 65% |
| 98% | 70% |

(App. supp. R4, tab 73)

54. Mr. Dethloff testified that ARC overexcavated and replaced excavated materials with gravel in 70 to 75 percent of the M2 excavations (R4, tab 1142; tr. 7/116).

55. There is no evidence that the CO authorized overexcavation and replacement of excavated materials with gravel, waived the requirement for a soils engineer to observe the excavations prior to pouring concrete, or approved any changes to the compaction standards in the contract (tr. 5/148).

C. Dewatering

56. Although 1998 was a rainy year, there is no evidence that ARC took steps to protect the excavations and it does not appear that ARC filed a claim based on unusually severe weather (R4, tabs 145, 146, 151; tr. 3/62, 5/130; ex. G-44 at 62).

57. On 19 June 1998, Mr. Klevberg advised Mr. Hampton, ARC's QC manager, to avoid placing fill in utility trenches with standing water and to pump water from trenches prior to placing fill. If standing water was not removed prior to placing fill, he warned that "[a]chieving the required densities may be virtually impossible." (R4, tab 141)

58. In his project report for 23 June 1998, Mr. Jones stated that Mr. Hampton had asked him to perform density testing on the footing subgrades at units 1009, 1013/1015, but that the excavations had "about 2" of standing water underneath [the] gravel." He advised that he was unable to perform the tests. (R4, tab 293 at 9; tr. 3/64-65)

59. Mr. Jones' project report for 29 June 1998 reported the following:

> Unit 7030...slab...under 3' water.... Also pointed out soil settling next to foundation wall (2' from wall).
> - Checked on MH [manhole] #40 (site of failure on 6/25/98 #6) 2 ½' water on the surface.
> - Decision to pour FTG for unit 7070 was made by someone.
> - LaRue asked me what I thought [about] pouring FTGs in an area that had 2 ½ [inches] standing water.... "I can't make that call, but I don't think its a good idea."
> - Duane of Baer Constr: "It has gravel, it's not going anywhere."
>
> ....
>
> - Back to 7070, FTG Pour…while the pour was in progress, water was still being pumped from underneath gravel surface.

(R4, tab 297; tr. 3/65-66)

60. With respect to manhole 40, Mr. Jones testified as follows:

> Q. Did you ever have any problems with rainwater accumulating in the excavations?
>
> A. Well, let's see. There is a storm drain that went out of the northeast side of the site. I'm not sure if that's manhole No. 40 or something like that.
>
> But the J & K guys [were] struggling with getting water out of the trench because right next to the trench was a pond of water about four...inches deep and about 100 feet in diameter.
>
> They would pump the trench back into the pond, and the next morning the pond had drained back into the trench.

> And finally after about three or four days, [I said] why don't you just drain that crap across the road. And they pumped it across the road, and a few days later, they were able to get back in there and work.

(Tr. 3/62-63)

61. On 6 July 1998, Mr. Klevberg again advised ARC to dewater the excavations:

> [The] specification...require[s] [the Contractor] to dewater excavations. Water is not to be allowed to collect and stand.... Soils softened by standing water are required to be removed....
>
> [If water is allowed to stand where gravel has been placed], the very high permeability of the gravel relative to the subgrade silts and clays may result in saturation of the subgrade, potentially reducing [its] bearing capacity.... In the case of fat clay, swelling may result. It is therefore important to remove the water...as quickly as possible.

(R4, tab 145)

62. On 29 July 1998, Mr. Klevberg wrote Mr. Hampton as follows:

> [D]ewatering should have been anticipated.... Placement of gravel fill...in the base of [the] utility trenches would [be acceptable] if standing water and saturated soils…are removed prior to fill placement....
>
> …Placement of fill on top of saturated soils without dewatering is not permitted.

(R4, tab 146)

63. On 25 August 1998, Mr. Hampton stated as follows in his daily report:

> J&K is immediately backfilling areas of water encountered and compacting as to go unnoticed. I have asked [J&K] repeatedly to cease this procedure [to] no avail.

(R4, tab 849-09)

64. On 28 August 1998, Mr. Hampton reported that there was an "immediate cover-up [by J&K] of problem areas such as water encountered in trench[es]" and that he had observed an open trench with eight inches of water (R4, tab 834-08 at 1).

65. The record reflects water in the excavations on 23 June (53723, R4, tab 293 at 9); 29 June (R4, tab 297 at 3); 30 June (R4, tab 590 at 4); 22 July (R4, tab 838-11 at 2, 3); 23 July (R4, tab 838-12 at 2); 29 July (R4, tab 836-05); 5 August (R4, tab 328 at 5); 13 August (R4, tab 337 at 6); 21 August (R4, tab 341 at 10); 24 August (R4, tab 344 at 6); 1 September (R4, tab 351); 2 September (R4, tab 842-8); 15 October (R4, tab 836-60 at 2); and 17 October 1998 (R4, tab 834-13).

D. Perimeter Foundation Drain (PFD)

66. The approved drawings called out trench footings with an exterior PFD correctly placed on top of the footings (53723, R4, tab 5 at drawing A6.1; ex. G-19). In order to intercept moisture moving through the backfill before it reached the expansive subgrade soils under the footings, the drain had to be placed at the interface between the backfill and the subgrade where water collects (ex. G-44 at 36-37). Shortly after contract award, ARC began using spread footings (R4, tab 983; ex. G-44 at 39-40). However, the design of the PFD was not modified to reflect the change. As a result, the drain was too high to be effective. The problem was exacerbated by ARC's placement of ½-inch to two-feet of gravel or more under the footings, which raised the drain even higher above the correct location. (Ex. G-44 at 40)

67. On 28 August 2008, Mr. LaRue advised Capt Cantwell of some needed field changes. Item 12 provided as follows:

> Perimeter drain tile is designed at top of footing and sets the level where water will be taken off of gravel fill. [Given the change in the method of constructing footings] [t]his creates a holding area for water under [the] slab that can not [sic] be drained by the current sump pump and basin. Existing basins will have to be modified to collect water at a lower level and the sump pump lowered to drain basin. [D]rain tile must be relocated to bottom of footing.

(R4, tab 846-05 at 2)

68. On 28 September 1998, Mr. Klevberg recommended that the sumps be perforated with 500 3/8-inch diameter holes around their circumference and lowered to allow water trapped in the gravel to drain (R4, tab 150; tr. 5/97-100).

69. ARC did not implement these recommendations (tr. 5/100-05).

E. Lifts

70. In April 1998, J&K asked Mr. LaRue if it could use lifts of more than eight inches:

> J & K...had a large piece of equipment...they felt...could get the required compaction by using a heavier lift....
>
> I went to the specifications.... [Told them] this is what the spec requires.
>
> And what was requested of J & K [was] to prove that they could do what they said. So they tried to do a small section of a trench, overfilling it and using their equipment getting the compaction, and then a backhoe coming back and digging to the lift heights that would have been required if they would have done it per specs. And a Maxim representative was there testing for verification of those lifts.
>
> At that time, the technician told me he could get 16 to 24 inches accuracy.... If we were to have three lifts of eight inches, that's 24 inch, which was the maximum.

(Tr. 4/119-20)

71. By memorandum dated 23 April 1998, Mr. LaRue advised Mr. Magyar that every third lift could be tested (app. supp. R4, tab 710; tr. 4/147-49).

72. On 15 June 1998, Mr. LaRue told Mr. Klevberg that the government had approved testing every third lift, but that the lifts still had to be eight inches (53723, R4, tab 288).

73. On 19 June 1998, Mr. Klevberg advised ARC to follow the "specifications by placing fill in 8-inch lifts:"

> Thinner lifts provide for more uniform compaction and allow compaction to be achieved relatively quickly. A few passes with the vibratory roller should provide the requisite compaction of an 8-inch lift, while a much thicker lift may

> not produce the specified compaction even after many passes with the compactor....

(App. supp. R4, tab 69)

74. Mr. Jones testified that ARC regularly placed backfill in lifts of three feet in the foundations and utility trenches and two feet in the garage areas:

> Q. [H]ow thick were the...lifts [in the utility trenches]?
>
> A. Well, on the average, three feet. Some more.
>
> Q. And what was the basis of your understanding that you were to test every three-foot lift?
>
> A. I'm not sure where that came from. I mean, it was three foot from the git-go at the start. So, I don't know how that number came about.
>
> ....
>
> Q. …[W]hat about the foundation backfill[,] how thick were th[os]e lifts...?
>
> A. About three feet on most cases
>
> ....
>
> Q. And how thick were the lifts [in the garages]?
>
> A. For the garage, it was right at two feet. For the other areas, it came up about three feet.
>
> Q. And so...were you testing each eight-inch lift, then?
>
> A. No.

(Tr. 3/46-51)

75. He also testified that ARC frequently timed its backfill operations so that he could not observe placement of the lifts:

Q. What happened when you were not around to observe the backfilling?

A. A lot of times when I went to recheck the holes, things looked pretty different.

Q. What do you mean?

A. Well, the lifts [were] a little bit higher than normal when I last seen them. Things changed.

Q. Did you ever take any measures to deal with that?

A. Well, I kind of noticed that sometimes if I would watch them from a far distance, if I'm working one end of the site...they move a whole lot of dirt. And then as I get closer, things slow down.

....

A. Well, I remember one particular day, I was watching the foundation fills, doing concrete. They were doing trench fills.

And I have a truck parked on a bit of a knob, and I was trying to be in three places at the same time. Then I kind of peeked over so I could watch what they were doing, and they were doing things pretty even.

A few days later, I started to park my truck where it's more visible, and that worked for a day or two.

Then after they found out there was nobody in the truck, things went back to moving dirt again.

And I had this old mop and hard hat. I parked the truck out in front and stuck the mop in the driver's seat and the hard hat on top, and that kept things going pretty good for a while while I was busy doing something else.

(Tr. 3/83-85)

76. Mr. Jones voiced his concern about the thickness of the lifts to ARC's QC manager:

> A. One case in particular where they came up to grade, I believe it was a curb inlet going across the street, one time I got to them, they were right up to street grade level.
>
> And I talked to Chuck [Strickland], who happened to be the QC guy at the time, they filled right up to the grade. What do you want to do? Do a density test on top.
>
> Okay. That's what I did.
>
> Q How deep was the fill material underneath that?
>
> A. Oh, about six or eight feet.

(Tr. 3/54-55)

77. Mr. McMahon observed lifts of two to two-and-a-half feet in the foundations and utilities "on a fairly regularly basis" and was of the opinion that "very little care [was] taken in compacting around all of the M2 units" (app. supp. R4, tab 1428 at 339; tr. 9/105-09). He stated that there were times when ARC finished the backfill after he had gone for the day (tr. 9/156).

78. Mr. LaRue observed 24-inch lifts in the utility trenches (tr. 4/191-93).

79. Although Mr. Dethloff asserted that ARC's on-site equipment could compact lifts of two feet or more, Mr. Klevberg stated that it could only adequately compact lifts of 8 to 16 inches (tr. 7/117-18, 176; ex. G-9, Klevberg dep. at 121). We find Mr. Klevberg's testimony on this point persuasive. Moreover, the nuclear densometer used by Mr. Jones to test compaction had an eight inch probe that could only test to a depth of 10-12 inches. (Tr. 3/59-62; ex. G-44 at 84)

80. Mr. Juel agreed "there's no way to test 36 inches of compacted material without digging down through 24 inches of it" (ex. G-9, Juel dep. at 244). When asked about testing 24-inch lifts, Mr. Klevberg stated "[we] wouldn't be testing that 24-inch thickness, we would be testing the top lift" (ex. G-9, Klevberg dep. at 125).

81. Mr. Dethloff testified that ARC had placed fill in "anywhere from 15 to 18 inches" lifts around the foundation walls (tr. 7/119). Mr. Gauvin testified that ARC

started out using eight-inch lifts around the foundation walls, but increased the size of the lifts to "between 10 and 12 inches, roughly, give or take." He did not remember the CO approving a change to the lift size and there is no evidence that the CO approved such a change. Mr. Gauvin thought that thicker lifts were acceptable because "everybody on the site [knew what] was going on" and the inspectors "seen [sic] me doing it." (Tr. 8/51-53)

82. Mr. Nelson testified that ARC placed and compacted the backfill too quickly, and in large lifts, sometimes up to four and five feet in depth. He discussed this with Mr. Gauvin to no avail. In Mr. Nelson's experience, it takes two to three days to properly place and compact backfill. ARC performed the work in a few hours. (Tr. 3/173-74)

83. Some areas were not compacted at all. Mr. Klevberg noted in his project report for 26 May 1998 that J&K and Baer, another subcontractor, "tend[ed] to fill trench[es] in without compaction or testing" (53723, R4, tab 272). Mr. Jones' project report for 26 May 1998 stated that J&K "apparently backfilled over [a] failing area w/ a gravel material" while he was at a doctor's appointment (53723, R4, tab 273 at 6-7).

84. On 15 June 1998, Mr. Klevberg reported that sewer trench backfill "appears to be going in 4 ft. lifts" (53723, R4, tab 288).

85. In July 1998, Mr. McMahon observed sinkhole settlement in the foundation wall backfill of one of the first three units constructed, which caused him to believe that settlement would be an ongoing problem (tr. 9/125-26, 129).

86. On 5 August 1998, Mr. Jones reported that "a total of 6'+ fill was added over the storm drain pipe, with no tamping and no lift intervals [and that] [t]he fills were placed in one operation with a surface rolling" (53723, R4, tab 328 at 5).

87. On 6 August 1998, Mr. Magyar, ARC's superintendent, "noticed J&K backfilling at [front of] bldg #7098 & 7096...with no compaction lifts" (R4, tab 836-01).

88. On 28 August 1998, Mr. Hampton noted that J&K was placing backfill in lifts of up to five feet (53723, R4, tab 834-08 at 1).

89. On 1 September 1998, Mr. Klevberg observed what appeared to be an eight-foot lift being placed in a waterline trench (53723, R4, tab 351).

90. On the same date, Mr. Jones reported that the garage slab backfill at unit 7040 was being placed in 2 ½ to 3 foot lifts (53723, R4, tab 672 at 4).

91. Project Monthly Review (PMR) meetings were held every month and attended by contractor and government personnel. The CO attended some of the meetings. (Tr. 4/63; ex. A-6 at 61)

92. On 1 January 1999, Capt Miller became the PM. He spent about one week per month at the base, of which 1-2 days were spent "walking the site." A typical week was as follows:

> [W]e would have...our own internal government meetings of inspectors...who would walk me around the site...and then we – I'd say not every time, but most of the time a [CO] was with me – we would travel the site, look at the issues and ...sit down with ARC and work through to what was going on....

(Ex. A-6 at 15)

93. Capt Miller testified that Mr. LaRue questioned the thickness of the lifts at several PMR meetings:

> A. Most of the discussions were [about]...Ron LaRue['s]...concerns [as to]...how large the lifts were on the backfills in the basements.
>
> Q. And what were his concerns?
>
> A. [At] several meetings[,] he discussed his concerns with the equipment that was being used and...how large quantities of dirt were being pushed in....
>
> Q. About how many times would you say that he related that inappropriate equipment was being used?
>
> A. It was several. I know that it was a continual discussion for several months with ARC at our monthly meetings on site.
>
> Q. And what...did [he] say about the size of the lifts?
>
> A. I can't remember specifically, just that they were much greater than what the specifications read.
>
> ....

Q. Was Rebecca Rounsavill at any of these meetings?

A. Yes.

Q. Did you discuss with Rebecca Rounsavill Mr. LaRue's observations about the...lift size?

A. Yes.

....

Q. Was this observation addressed with ARC?

....

A. [I] addressed it with ARC, [but] they came back [saying]...they were doing it right. [W]e even went back [to] their soils contractor to clarify that the way they were doing it was appropriate[,] so essentially I let it go at that, but indications started to occur that there were problems around those compaction zones....

(Ex. A-6 at 57-62)

94. At the PMR meeting of 16 April 1999, Mr. LaRue advised that some of the egress windows were not backfilled and compacted properly and that they were sinking. ARC indicated they would check them. (R4, tab 844-68)

95. On his QC report for 8 June 1999, Mr. Cattaneo, stated as follows:

> In walking the site today I'm finding more and more broken sidewalks due to settling of backfill. Holes 9, 10, 11 all have sidewalks that have broken.... Also, backfill of foundations must be done in lifts, evidently that wasn't happening at M-2. The backfill problem in M-2 is rearing its ugly head more and more. Unfortunately, I foresee more and more problems arising from this.

(R4, tab 1268)

96. Mr. Cattaneo reported the following on his 10 June 1999 report:

> Took photos of all stoops and garage walls that are settling...in order to show corporate what's going on. Created an accurate list of damage due to settling of soils in Phase I and II. It's ugly.

(R4, tab 1276; tr. 8/161)

97. On 10 June 1999, Mr. Eugene Frederick, ARC's PM, advised Capt Miller as follows:

> For your information and not to be alarmed!
>
> As you know we are seeing some undermining of some stoops, in the Cypress and Briarwood...area.

(Ex. A-6 at ex. 6)

98. Capt Miller testified as follows regarding Mr. Frederick's memorandum:

> Q. Were you aware...in June of 1999, of an issue with the stoops[?]
>
> A. Based on this information[,] I would say yes[.]
>
> ....
>
> Q. What was the first thing you thought of when you got this memo[?]
>
> ....
>
> A. In my opinion, it would have been compaction of the soil beneath those areas.
>
> Q. Was that the first thing you thought of?
>
> A. Yes.
>
> Q. And why did you think it was compaction?
>
> A. Based on the construction method used and [my] observations[.] [P]its were dug out to build the basement

> foundation walls and when you would observe around the houses that essentially that zone of pit digging...which I call about 10 feet, 10, 15 feet outside of the basement walls, that's the areas that things around the houses were settling in, anything that had any weight and really did not observe a lot of that until significant watering went on when the sod was laid down.
>
> A. That would have been at or about this time, spring, summer, so June.

(Ex. A-6 at 68-67)

99. On 12 June 1999, Mr. Cattaneo noted on his QC report that "another garage floor...has dropped approx 1." Hole 8B. This is the unit the stoop dropped in also." (R4, tab 1279)

100. On 12 July 1999, Mr. Kraybill reported that he had "[r]echecked units in phase I in need of major concrete repair involving either wall separation at garage or garage slabs sinking. Garage slabs in need of pump raising are holes 4B, 5A&B and 8. Units in need of garage foundation wall raising include 11A, 12A, 15A & B, and 18A & B...." At hole #15, the helical repair crew was having difficulty finding anything on which to found a helical pier and the concrete pumping crew at hole 8B was having difficulty raising the garage slab. (R4, tabs 1306)

101. On his daily report for 13 July 1999, Mr. LaRue noted that ARC was "mudjacking" hole #3 (R4, tab 848-96). He described mudjacking as follows:

> It's lifting of an existing concrete slab by core drilling...two-inch diameter holes and putting a hose in there and then forcing a slurry of concrete underneath it to fill the voids and lift it.
>
> Q. [Was] this mudjacking...necessary because there were voids underneath the slab?
>
> A. Voids or settlement, yes.
>
> ....
>
> Q. [I]sn't it a fact that in July of 1999, your belief was that these voids were attributable to insufficient compaction?
>
> A. Yes.

(Tr. 4/140, 163-64)

102. Holes #10 and #11 were also mudjacked in July of 1999 (R4, tab 848-98; tr. 4/167). When asked if "the [CO] actually knew of this mudjacking procedure," Mr. LaRue stated:

> I showed it to…[Rebecca Rounsavill and...I believe it was Capt. Miller].... We toured the site, showed it to them.

(Tr. 4/166-67)

103. On 13 July 1999, ARC showed Mr. Klevberg "several sidewalks, driveways, stoops, and garage slabs that were showing evidence of differential movement." Mr. Klevberg did not find evidence of heaving, but advised of various drainage problems and the poor backfilling and structural fill placement practices used in 1998. Mr. Klevberg concluded that "lack of proper compaction...could account for much of the trouble...." (R4, tab 601)

104. By July 1999, settlement had increased to the point that Capt Miller was concerned about a negative drainage problem (ex. A-6 at 72). When asked why he related the "cracking or the settlement or the negative drainage to the backfill or the compaction," he replied that those were standard indicators of inadequate compaction. He explained that the presence of those indicators, combined with the watering that was taking place at the time, led him to conclude that the soils had not been adequately compacted. (Ex. A-6 at 75-76) He saw no other solution "than to excavate and replace it and compact it." He was "sure" he discussed that solution with the CO in the summer of 1999. (Ex. A-6 at 82)

105. On 15 July 1999, Montana Helical began installing piers to raise three garage slabs and two garage foundations (tr. 4/167; R4, tab 1458). A helical pier is "like a large screw that's driven into the ground to a point of calculated resistance, and then a cap is put on the top of it that will support or lift an existing structure" (tr. 4/167-68). To get the proper bearing, "a couple of holes went up to 80 feet" (tr. 4/132). Mr. LaRue sent photographs of the repairs and a narrative to the CO (tr. 4/170).

106. In mid-June 1999, Mr. LaRue noticed that the garage at hole 15 had rotated off the building and that the garage slab at hole 5 had settled three inches. As a result, he performed a settlement survey of all the buildings in phases I, II, and III.

107. Mr. LaRue's deposition testimony describes this survey as follows:

> I did my own [survey], checking every unit for rotation of the garage foundations, cracking of the joints, settlement of the stoops, settlement of the garage slabs. That type of information, negative drainage of grade to the building.
>
> "QUESTION: When was that?
>
> "ANSWER: Mid-1999...when what we call...Hole 15, the garage on that one, rotated off the building. Noticed in Hole 5 across the street the slab in the garage settled three inches[.] I see those deficiencies, pass them to the Government. They say check them all. I went out and checked them.

(R4, tab 1688; tr. 4/116, 171-73)

108. Mr. Carlin's memorandum of 19 October 1999 to Soltek indicated that Mr. LaRue's survey identified 60 possible problem areas (R4, tab 1458).

109. On 28 June 1999, Mr. Kraybill reported the following:

> Found sunken garage slab at hole 4B and major garage foundation problems at 15B where [sic] re-viewed as well.... This is the single most serious problem with M2. Repairs of these will run into some big $.

(R4, tab 1292)

110. On 20 July 1999, Mr. Jones reported a lack of test points at lower levels (R4, tab 619 at 3-4, tab 655 at 6, tab 717 at 3, tab 750 at 3).

111. By 22 July 1999, nine gas lines were sinking (R4, tab 1402 at 037379, 037381).

112. On 3 September 1999, Mr. Frederick advised Energy West, ARC's natural gas subcontractor, as follows:

> [On] September 3, 1999...I received a phone call...informing me that [the base had] dispatched the fire department...to unit 1006 Briarwood Ct. [because the] tenant...smelled gas fumes. The fire department...shut off the gas.... I dispatched my site superintendent...to investigate.... ARC notified Energy West [who made repairs] and the gas service was turned back on.

(R4, tab 1402 at 037382)

113. At Mr. Frederick's request, Mr. Kraybill researched possible causes for the sinking gas lines. On 14 September 1999, he advised Mr. Frederick as follows:

> In my opinion, the following caused the settling.
>
> Basement wall backfill poorly compacted.
> Spring & summer watering causes settling, taking the gas pipe ...down with it.
>
> ...Only one compaction test below finish grade...was normally taken on wall backfills."

(R4, tab 1391 at 2; ex. G-9 at 26-27)

114. On 14 September 1999, ARC, Energy West, and Great Falls Construction, the gas line installer, met to discuss the sinking gas lines. At the conclusion of the meeting, Mr. Frederick stated as follows:

> I think that we have poor compaction from the building to 5' out [that] is pulling down on that line. With the pulling down on the line, you can see a number of cases here where it is just pulling it right off of that coupling....

(R4, tab 1395 at 030381)

115. On his QC report for 16 September 1999, Mr. Kraybill reported sunken asphalt at the curb line of hole #4 (7036):

> The sunken spots...fall in the general path of the two water services to this building.... Almost none of the water service line trenching in M2 was tested or at least we do not have copies.... My best "guess" based upon physical evidence and my 14 years experience in underground construction is that bridging occurred during backfill of the...lines and subsequent water penetration (natural not leakage) has caused consolidation to take place in the lower trench zone.

(53723, R4, tab 1399)

116. On 7 October 1999, ARC personnel met to discuss the sinking gas lines. The minutes of that meeting stated, in part, as follows:

> Barry [Magyar's] daily report from 1st of July [1998] says that they overexcavated 7068 due to rain and that rock would be brought in. Heavy rain bursts while the hole was open. [Mr. Magyar was the superintendent at the time.] Ron [Gauvin] does not...remember them taking the rock out after a rain.... Ron believes that holes 5, 6, 9 & 10 were all sitting open when the rains came last year.
>
> ….
>
> We do know that 11B had a cracked garage wall...[and] that we...repaired [it] once before. We have already replaced 11A trash enclosure & A/C base....
>
> The sidewalk between 11 A & B is falling towards the house and the yard is falling away from the house. The garage is falling away from the house on 11 B. There is a major crack in the ceiling [and the] tape has come apart from the ceiling & the wall.
>
> ….
>
> (At this point they called Barry Magyar in Puerto Rico) Barry said [the hole was overexcavated to remove] silty material.... There was about 24" of rock placed under the footing.... Barry asked if the crack on the inside corner...of the front door was back and [we] confirmed that it [was] and that it had also cracked by the A/C again....
>
> ....
>
> We need to be more careful in the excavation to make sure the fatty dirt is separated from the rest.... We also need to make sure it is compacted thoroughly.

(R4, tab 1428)

117. Mr. Kraybill's 7 October 1999 QC report noted the following regarding hole 11B:

> Garage is pulling away from the house very badly. Garage door is at least 5" out of level and the siding has crinkled from stress forces. [Per Mr. Magyar's daily report,] this unit was over excavated several feet due to very wet conditions. It was then backfilled with a gravel material that contained virtually no "fines[,]" creat[ing] a huge pocket for water to migrate into. Settling or collapsing of soils below or near this area is a natural result over time. The key issue here, in my opinion, was the type of backfill material used. Had it been a "well graded" material with a gradation allowing for the compacted filling of spaces between the rock then the French Drain effect would not have come into play.
>
> The same effect was noted in several of the driveways in Briarwood Court which [were] excavated too deep and backfilled with the same "straight gravel" materials. These areas would attract water and funnel it...to the downhill back of curb edges of the driveways [which] would cause ponding. [When] I complained[,] [I] was told that this material was the specified and approved source and could not be changed. At some point in Phase III, however, the source and gradation was changed and the problems with driveways ceased.

(R4, tab 1444 at 2-3)

118. Mr. Carlin's 22 October 1999 memorandum to Soltek reported that soil subsidence was becoming a bigger issue (R4, tab 1463).

119. On 18 October 1999, residents noted that the stoops at holes 24, 25B, and 27 A&B were settling and that there was interior basement ceiling and wall damage at hole 25A (R4, tab 1453).

120. On 22 October 1999, Mr. Carlin advised Soltek that the "biggest construction challenge facing ARC on this contract is resolution of the soil subsidence issue." The memorandum also stated that ARC had discovered three new buildings with evidence of soil problems and that the Title II inspectors had identified two more buildings that they have been watching plus two areas in the main road that have demonstrated areas of subsurface failure. (R4, tab 1463)

121. On 24 January 2000, Mr. Darrin LeMaster, an assistant superintendent for the M3 contract, reported that "ARC has three laborers at hole #11 (M2) hand digging

around the foundation on the inside of the garage. Backfill is loose, poor compaction." (R4, tab 836-93)

122. There is no evidence that the CO approved testing every third lift or authorized the use of lifts thicker than eight inches.

F. Mr. LaRue's Weekly Reports

123. Mr. LaRue prepared weekly field reports and mailed them to the CO at Brooks AFB, Texas (tr. 4/62). Virtually all of his reports between 11 June 1999 and 4 January 2000 referenced sinking and/or settling stoops, trash enclosures, garages, or removal and/or repouring of sunken stoops and trash enclosures (R4, tab 834-64 through 843-93).

G. ARC's Quality Control Reports

124. ARC filed its QC reports in a bookcase in its job site trailer. Mr. LaRue testified that ARC never denied him access to the reports and that, although he sometimes looked at the reports, he never asked ARC to give them directly to him. (Tr. 4/198-99) Mr. McMahon testified that he reviewed about 2 percent of the QC reports (tr. 9/132). Capt Miller, the PM through 5 September 2000 did not recall seeing any QC reports and was not aware that the reports were not being submitted to the inspectors (ex. A-6 at 47).

H. Maxim's Compaction Test Reports

125. Mr. Jones did not know that the specification required fill to be placed in eight-inch lifts. He understood that he was to test every three-foot lift and did not test every eight-inch lift (tr. 3/47-53).

126. At the hearing, Mr. LaRue testified that he interpreted the specification to require one test for every eight-inch lift. During his deposition, however, he testified that he interpreted the specification to be volume-based, meaning that each "eight -inch lift by itself need not be tested unless and until that eight-inch lift involves 2,000 square feet." (Tr. 4/135-48) When asked if he interpreted the specification to be a volume-based specification during the project, he testified that "I can't say that I did" (tr. 4/145).

127. Mr. Jones used a portable nuclear densometer to test in-place moisture and density (tr. 3/47). The machine operated as follows:

> [The machine] has two radioactive sources in the probe, which...extend[s] into the soil.

> …One source produces gamma radiations, and the other one neutron. Neutron is stored by moisture. That's how [you measure] the moisture content....
>
> Gamma is stored by the density.
>
> [T]he machine...measures the difference between the position of th[e] probe and scatter back up.
>
> ....
>
> The probe extends eight inch, but I have to punch a hole ten inch....
>
> ….
>
> ...If I got a certain amount of counts per minute on the dry and wet, I go to a chart and convert it to a dry density and a wet density.
>
> Then...I used the proctor, which is the lab result from [Maxim's] testing of soils...what they call optimum density moisture. Then that's calculated against the density...to get the percentages [of compaction].

(Tr. 3/21-23)

128. A Proctor curve is created by compacting a soil sample in the laboratory at increasing moisture levels to create a "curve." The top of the curve reflects the maximum dry density and the optimum moisture content needed for compaction (ex. G-9, Juel dep. at 135). To properly compact a particular type of soil, the soil needs to be compacted near its optimum moisture content. For expansive soils, the moisture content should be above the optimum moisture content. (Ex. G-44 at 102) If the soils are heterogeneous, as here, it is more difficult to develop a curve that reliably reflects the level of compaction (tr. 5/93, 178-79). The percentage of compaction is computed by dividing the measured dry field density by the maximum density of the applicable Proctor curve (53723, R4, tab 43a at 1; tr. 3/23). The resulting percentage is then compared to the specification. For example, a measured dry field density of 87 divided by a maximum density of 93 (Proctor curve 2610) yields 93.5 percent compaction, which meets the requirement for backfill around basement walls (92 percent of the maximum density of ASTM D 698), but does not meet the requirement for trenches (98 percent of the maximum density of ASTM D 698).

129. Selecting the proper Proctor curve involves some judgment. Each blend of soil requires the creation of a laboratory-created curve. Maxim created 12 to 14 curves for this project. (Ex. G-44 at 103, ex. G-9, Klevberg dep. at 88) Mr. Kovski testified that Proctor curve 2610, which had a maximum density of 93 percent, was the most frequently used curve, which suggested that it may have been selected to ensure passing test results. For example, if the measured dry field density of a sample is 93.5, the percentage of compaction resulting from the application of Proctor curve 2610 would be 100.5 percent (93.5 divided by 93), which would meet all levels of compaction required by the specification. However, if Proctor curve 2714, which has a much higher maximum density (103 percent) was used on the same sample, the percentage of compaction would be 90.8 percent (93.5 divided by 103), which would not meet any of the compaction requirements of the contract. (Ex. G-44 at 101-07)

130. Areas that failed had to be retested. To be valid, a retest has to be performed at or near the original test (tr. 3/71-72; ex. G-44 at 93). Changing the elevation of a retest to the next higher lift or adding more soil without reworking the area is not a proper retest (tr. 3/72).

131. During the testing, Mr. Jones prepared handwritten notes recording, among other things, the date of the test, the location, the number of counts, the measured dry field density, the specification requirement, the name of the person who selected the test location, the applicable Proctor curve number, the maximum density of the selected Proctor curve, and any comments regarding the test (tr. 3/28-34; R4, tab 283 at 5). At the end of each day, Mr. Jones mailed his notes to Maxim's headquarters in Helena, Montana, where they were typed onto a "Report of In-Place Density" (tr. 3/47).

132. On 6 July 1998, Maxim headquarters sent a memorandum to Mr. Klevberg, Mr. Jones, and Mr. Sivumaki with a list of 37 failed tests "to give [them] an idea of how many failed tests are slipping through the cracks." Only 11 of the 37 tests had been retested and passed as of the time of the memorandum. (R4, tab 144) In addition, Mr. Jones' project reports listed multiple failed tests that were not retested at the time of reporting. For example, failed tests were not retested on 2 September 1998 (R4, tab 352 at 7); 10 September 1998 (R4, tab 357 at 3); 22 September 1998 (R4, tab 365 at 8); 1 September 1999 (R4, tab 672 at 4); and 1 September 1999 (R4, tab 705 at 4; *see also* tr. 3/72-78; ex. G-44 at 93-94).

133. At first, Mr. LaRue was included on the distribution list for the typed reports issued by Maxim headquarters (R4, tab 297; tr. 3/36). On or about 3 August 1998, however, ARC's QC manager, Mr. Hampton, asked Mr. Klevberg to stop sending Maxim's "products or deliverables or reports or letters" to Mr. LaRue. Mr. Klevberg complied with the request. (Tr. 5/95-96; R4, tab 148)

134. In her affidavit, Ms. Alice K. Long, ARC's office assistant from 14 September 1998 through 17 October 2000, stated as follows:

> I was the sole person responsible for [receiving the Maxim reports and] placing the[m] into binders. These binders were placed in the ARC conference room. The conference room was accessible to all ARC employees, however, non-ARC employees needed permission to access the conference room. I never distributed the Maxim reports to anyone. To the best of my knowledge the Maxim reports were not distributed by ARC to the Air Force or anyone else.

(R4, tab 852)

135. The government requested ARC to submit Maxim's compaction test reports on numerous occasions (R4, tabs 844-89 at 2, 844-90 at 2, 844-92 at 1, 844-95 at 1, 844-96 at 2, 844-151, 1556 at 3, 1614 at 1, 1622). At the 21 June 2000 PMR meeting, Mr. Dethloff advised that the test reports for the M2 contract were currently being copied in San Diego and that they would be sent to the government as soon as they were completed (R4, tab 844-91 at 3). ARC did not submit Maxim's compaction test reports to the government until 24 October 2000 (R4, tab 844-97 at 2).

VI. Acceptance of the M2 Contract

136. On 12 July 1999, Mr. LaRue sent the following memorandum dated 8 July 1999 to Capt Miller and Ms. Rounsavill in anticipation of the upcoming prefinal inspections:

> **SITE ISSUES TO BE REVIEWED BY CAPT. MILLER AND REBECCA ROUNSVILL** [sic]
>
> ***What are the acceptable limits for each of the following items?*** [Emphasis in original]
>
> Concrete
> 1. Extent of cracking of driveways.
> 2. Extent of cracking of sidewalks.
> 3. Extent of settlement of entry stoops from foundation or rotation.
> 4. Extent of settlement of sidewalks. ½" to match handicapped maximum?

5. Extent of settlement of patios at stoop….

Landscaping
1. Extent of grading slope away from buildings. Negative drainage to trash enclosures.

....

Garage
1. Misalignment of wall to foundation repair. Tony D. approved sample in Hole 5B.
2. Settlement of garage slabs and stoops.

(Ex. A-6 at ex. 7)

137. Mr. LaRue began conducting prefinal inspections in July 1999. After each inspection, he issued a punch list. When ARC finished correcting the punch list, Mr. Frederick, ARC's PM, sent a memorandum to Mr. LaRue indicating which items had been completed and which items had not been completed. For each item that had not been completed, he provided the date by which it would be completed or stated that it was in dispute. (R4, tabs 1310-1315, 1318, 1319) Mr. LaRue testified that the PM's memorandum meant that the units were "complete and ready for occupancy" (tr. 4/92-93).

138. Mr. La Rue accepted the units in four increments: 29 units were accepted on 30 July, 34 units were accepted on 30 August, 31 units were accepted on 30 September, and 28 units were accepted on 29 October 1999 (R4, tabs 1333, 1367-68, 1409, 1470). The government admits that the date of turnover/beneficial occupancy constituted acceptance of the units and that the one-year warranty period began to run from those dates (amended answer dated 3/2/04, ¶ 22). The government occupied the units immediately upon acceptance (53723, complaint ¶ 22; amended answer dated 3/2/04, ¶ 22; tr. 4/91). At turnover/beneficial occupancy, Mr. LaRue gave the government a list of units that "were within tolerance, but [should] be watched" (tr. 4/248-49).

139. We find that the government relied at time of acceptance on ARC's representation that the units were complete and ready for occupancy.

VII. Post-Acceptance

140. The minutes of the PMR meeting held at 10:00 a.m. on 21 October 1999 stated as follows:

10. Capt. Miller has concerns about warranty issues on the stoops. The number of stoops with problems keeps growing larger. There are 18 out of 96 units being discussed....

....

12. Capt. Miller was [also] concerned about 3 garages that could possibly start sinking....

(R4, tab 844-81)

141. The minutes of the PMR meeting held at 3:30 p.m. on 21 October 1999 stated as follows:

12. One garage on Phase I has [a] settling problem. ARC notified the testing lab, and they [will] test. ARC will contact Brooks, AFB with the results [and] a suggested repair.

13. Additional units that are being watched for settling problems are Unit 7098 and 7041. A number of entry stoops have settled.

14. Magnolia Drive has two dips in the asphalt between unit 7034 and Unit 7036.

(R4, tab 844-83)

142. On his daily production report for 19 January 2000, Mr. Gauvin stated as follows:

We have 17 stoops falling from BLDG's....

Hole 5B garage slab has settled.
This slab has already been mudjacked.
The proper fix would be to remove existing slab.
Dig out fill and re-compact....

(R4, tab 836-90)

143. At the 19 April 2000 PMR meeting, Ms. Rounsavill asked for Maxim's compaction reports (R4, tab 1556 at 3).

144. Mr. McMahon and others performed a "9-month warranty walk" on 18 May 2000. Mr. McMahon noted the following defects (paraphrased):

> Hole # 4: Trash enclosure settled ½ inch; concrete settled "quite a bit;" front stoop beginning to pull away from house; rock area under bay window low; and sidewalk sagged in the middle.
>
> Hole #5: Rock area underneath bay window low and "[d]efinitely doesn't have positive drainage."
>
> Hole #6: Downspout missed splashblock by three inches; concrete surround round pipe floating free underneath bay window and needs to be recompacted; and the whole front of hole #6 should be recompacted because it has settled quite a bit.
>
> Hole #8: At left side, stoop starting to pull away from house.
>
> Hole #10: Very sizeable crack in walk off front stoop and crack in garage wall; stoop starting to pull away from house; front yard on both sides needs to be releveled and compacted; concrete floating above ground on both sewer clean outs; left garage starting to move and cracks in garage; trash enclosure either settled or garage has heaved up about 1 to 1 ½ inches; stoop starting to pull away from house; garage starting to move and there is cracking.
>
> Hole #11: Both front stoops "really bad;" need to be replaced.
>
> Hole #12: Trash enclosures settled 1 to 1-½ inches; right front sidewalk settled; concrete visible on both planting areas ("could be a result of poor compaction"); and there was "some movement in the garage."
>
> Hole #13: Trash enclosure settled about ¾ inch; rock planting areas starting to settle; left stoop settled "quite a bit," causing the front walk to settle so much that it needed to be replaced; left garbage enclosure needed to be replaced due to serious settling.

> Hole #16: Stoop and sidewalk on the right side showed signs of movement and needed to be replaced; there was a large crack in front of the garage and a lot of settlement in front underneath both bay windows, right side was especially bad; and there was a large crack in the driveway and a crack in the front entrance that needed to be repaired.
>
> Hole #18: On right side, there was "[a] lot of movement in garage floor and on the inside stoop;" garage badly cracked and needed to be replaced, left garbage enclosure had settled about two inches and needed to be replaced. On left side, the stoop was beginning to pull away and garage step had settled about two inches.

(App. supp. R4, tab 1428 at 254-59)

145. On 11 July 2000, Mr. McMahon performed another warranty inspection. Of the units in phases I and II, approximately 89 showed signs of settlement. (R4, tab 1584)

146. On 12 July at 2000, the CO wrote ARC as follows:

> [Y]our company has scheduled stoop repairs on Hole 10 and 11 for next week. Capt Miller and I have requested for the past 9-months that [you]...show [us] that your repair method has been properly engineered....
>
> ...Since you still have not provided documentation…, I can only stress again that this is a design/build project, and that you are ultimately responsible for the success of your...plan.

(53723, R4, tab 32)

147. On 13 July 2000, ARC submitted a "temporary" fix for the stoops. The drawing was not stamped by a registered A/E. (53723, R4, tab 33)

148. ARC's Warranty Log lists 532 warranty items reported between 3 August 1999 and 5 October 2000, including numerous instances of sinking stoops, sidewalks, patios, and yards, and walls cracking in the basements, stairs, ceilings, and throughout the house (R4, tab 1636).

149. On 7 August 2000, TD&H issued its "Report on Ground Subsidence." The report stated, in part, as follows:

> 1. Front stoops and steps exhibit[ed] combinations of uniform settlement, outward rotation, and left or right tilting relative to the basement foundation walls....
>
> 2. Sidewalks have settled away from steps, stoops and foundation walls[,] result[ing] in displacements at control joints and isolation joints....
>
> 3. Ground settlement [was] evident due to the resulting negative drainage slopes adjacent to the basement foundation walls, displacements of utilities and fences, voids under concrete flatwork, and exposure of damp-proofing and insulation along exterior basement foundation walls.....
>
> 4. Garage slabs and foundations exhibited settlement relative to basement foundation walls....
>
> ....
>
> [T]he greatest settlement has occurred directly adjacent to foundation walls....
>
> ....
>
> It is not possible to say what the ultimate settlement...will be. Relative displacements up to 5 inches and a void of greater than 8 inches [have been] observed. Several repairs have undergone subsequent movement and displacement. It is prudent to assume additional settlement will occur....
>
> In summary,…the observed ground subsidence and resulting damage is primarily a function of inadequately-compacted soils placed as backfill in the basement and foundation excavations. Surface water infiltration is a contributing factor which facilitates and expedites settlement in the loose soils.

(R4, tab 1597 at 5-7; tr. 6/87)

150. Mr. David Cole replaced Capt Miller as the PM in September 2000 (ex. A-6 at 114). He has a Bachelor of Science in industrial engineering from Clemson University and a Master of Business Administration from the Citadel in Charleston, South Carolina. Mr. Cole is a registered professional engineer in the states of South Carolina and Nebraska, and has had multiple years of experience as a PM for the Navy and the Air Force (*id.* at 10-45).

151. On 11-12 September 2000, Mr. Cole and Mr. Perry Potter, one of AFCEE's division chiefs, visited the site (ex. A-4 at 114-16, ex. 60). During the visit, Mr. Cole was advised that there were compaction problems on both projects. He observed areas "where the soil had...dropped down a couple of inches," as evidenced by the fact that the dampproofing was visible above the building line. He also observed soil subsidence of approximately one inch in phase III. The settlement was, in his words, "self-evident." (App. supp. R4, tab 528; ex. A-4 at 117-122, 160)

152. Mr. Potter's trip report, which was dated 12 September 2000 stated, among other things, that settlement around the foundations continued to be a significant problem and that the base was having problems with compaction in all phases, especially in phases I and II. The report also stated that ARC had stopped working on the stoops and that the basements were showing some cracking problems. (Ex. A-6 at 116, ex. 62)

153. After viewing the site and reading TD&H's report, he concluded that "compaction had not been performed" and that "[w]e had a problem" (ex. A-4 at 131-36).

154. On 29 September 2000, Mr. Cole requested the CO to obtain copies of Maxim's compaction test reports (R4, tab 1622).

155. On or about 3 October 2000, Mr. Dethloff requested Maxim to randomly review its project reports. Maxim reported the following results to Mr. Dethloff. There is no evidence that the results were disclosed to the government:

> [T]ests were taken at locations and elevations directed by [ARC] and test results were given to [ARC] on a daily basis. Our...individual test results may not have been representative of the fill for its entire depth and extent. Numerous problems and concerns about fill placement were expressed[,] includ[ing] moisture content, too thick of lifts, inconsistent and poor fill placement and compaction procedures…voids within the fill, and...test[ing] on the surface of deep lifts [only].

> [Our review] suggests that the fill was not placed uniformly to a condition which would preclude future settlement....
>
> [C]urrent conditions continue to exacerbate ongoing problems. Because of the settlement, reverse drainage conditions exist at some...areas. This settlement directs and/or captures surface water [which] provid[es] a direct water source which continues to wet the fill.

(R4, tab 164)

156. On 1 November 2000, the CO directed ARC to repair settled stoops and other items, attaching a copy of the government's settlement survey for phases I and II. As of 30 October 2000, the survey indicated that 41 of 68 stoops remained to be repaired and that ARC had not completed any of the multiple repairs required in the front rock area, the trash area, the rear stoops, and the rear walks at the patios:

## ELDERBERRY COURT

| STREET ADDRESS | FRONT STOOP | FRONT ROCK AREA | TRASH AREA | REAR STOOP | REAR WALK AT PATIO | REMARKS |
|---|---|---|---|---|---|---|
| | | | | | | |
| 1000 | X | X | X | | X | Grass areas settled near areaway. |
| 1001 | X | X | | X | | A/C unit is settled. |
| 1002 | X | X | | | | |
| 1003 | X | X | | X | | |
| 1004 | X | X | | | X | |
| 1005 | X | X | | | | Grass area settled near areaway. |
| 1006 | X | X | | | X | |
| 1007 | X | X | X | X | | |
| 1008 | X | X | | | X | |
| 1009 | X | X | | X | X | |
| 1010 | X | | | X | | |
| 1011 | X | | | X | | |
| 1100 | X | X | | | | A/C unit is settled. |
| 1101 | | X | | | | Grass area settled near areaway. Front stoop repair in progress. |
| 1102 | | X | X | | | Front stoop repair in progress. |
| 1103 | | X | X | | X | A/C unit is settled. Front stoop repair in progress. |
| 1104 | R | X | | | X | |
| 1105 | R | X | | | | |
| 1106 | R | | | | | |
| 1107 | R | | X | | | A/C unit is settled. |
| 1108 | R | X | | | | |
| 1109 | R | X | | X | | |
| 1110 | R | X | | | X | |
| 1111 | R | X | | | X | |
| 1112 | R | X | | | X | |
| 1113 | R | X | | | X | A/C unit is settled. |
| 1114 | R | X | | | | |
| 1115 | R | | | | | |

## DOUGLAS FIR DRIVE

| STREET ADDRESS | FRONT STOOP | FRONT ROCK AREA | TRASH AREA | REAR STOOP | REAR WALK AT PATIO | REMARKS |
|---|---|---|---|---|---|---|
| | | | | | | |
| 1101 | X | | | X | X | Serious settlement at rear stoop. |
| 1103 | X | | X | X | X | |
| 1105 | X | | | | X | Settlement at front sidewalk along street. |
| 1107 | R | | | X | | Settlement at front sidewalk along street. |
| 1109 | X | | | | | Settlement at fence between 1109 and 1111. |
| 1111 | X | | | | | |
| 1113 | X | | | | | |
| 1115 | X | | | | | |

## MAGNOLIA DRIVE

| STREET ADDRESS | FRONT STOOP | FRONT ROCK AREA | TRASH AREA | REAR STOOP | REAR WALK AT PATIO | REMARKS |
|---|---|---|---|---|---|---|
| | | | | | | |
| 6400 | | X | | | | |
| 6402 | | X | | | | Settlement at rear rock area. |
| 6404 | | | | | | |
| 6406 | | X | X | | | |
| 6408 | | | | | | |

## BRIARWOOD LOOP

| STREET ADDRESS | FRONT STOOP | FRONT ROCK AREA | TRASH AREA | REAR STOOP | REAR WALK AT PATIO | REMARKS |
|---|---|---|---|---|---|---|
| | | | | | | |
| 1100 | | | | | X | |
| 1101 | | | | | X | Front apron is settled. |
| 1102 | | | | | X | |
| 1103 | X | | | | X | |
| 1104 | | X | | | X | |
| 1105 | | | | | X | Front stoop is chipped, but apparently not from settlement. |
| 1106 | | X | | | | |
| 1108 | | | | | | |
| 1110 | | | | | | |
| 1112 | | X | | | X | Rock area is badly settled. Rear walk is tripping hazard. |
| 1114 | | X | | | X | Rock area is badly settled. Rear walk is tripping hazard |
| 1116 | | | | | | |
| 1118 | | | | | | Front apron is settled. |
| 1120 | R | | X | | X | |
| 1121 | | | | | | Front apron is settled. |
| 1122 | R | | | | | |
| 1123 | | | | | | Front apron is settled. |
| 1124 | R | | | | | |
| 1125 | | | | | | Front apron is settled. |
| 1126 | R | | | | | |
| 1127 | | | | | | |
| 1128 | | X | X | | X | |
| 1130 | | X | | | X | |
| 1132 | | | | | | |
| 1134 | | X | | | X | |
| 1136 | | X | | | | |
| 1138 | R | | X | | X | |
| 1140 | R | | | | X | |
| 1141 | | | | | X | |
| 1142 | | | | | | |
| 1143 | | | X | | X | |
| 1144 | | | | | X | |
| 1145 | | | | | | |

## BRIARWOOD COURT

| STREET ADDRESS | FRONT STOOP | FRONT ROCK AREA | TRASH AREA | REAR STOOP | REAR WALK AT PATIO | REMARKS |
|---|---|---|---|---|---|---|
| | | | | | | |
| 1000 | R | | X | | | |
| 1001 | R | | | | X | Stoop is chipped. Settlement at driveway. |
| 1002 | X | | X | | | |
| 1003 | | X | X | | X | |
| 1004 | | | X | | X | Settlement at driveway. |
| 1005 | R | X | | | X | |
| 1006 | R | | X | | X | |
| 1007 | R | X | | | X | |
| 1008 | | X | X | | X | |
| 1009 | R | | | | X | Garage stem wall is settling. |
| 1010 | | | | | X | |
| 1011 | R | | X | | X | Garage stem wall is settling. |
| 1012 | | X | X | | | |

## CYPRESS COURT

| STREET ADDRESS | FRONT STOOP | FRONT ROCK AREA | TRASH AREA | REAR STOOP | REAR WALK AT PATIO | REMARKS |
|---|---|---|---|---|---|---|
| | | | | | | |
| 1000 | | | X | | X | Settlement at front apron. |
| 1001 | | | | | | |
| 1002 | | | | | X | |
| 1003 | | | X | | | Settlement at A/C unit and rear rock bed. |
| 1004 | | | | | X | |
| 1005 | | X | X | | X | |
| 1006 | | | | | | A/C unit is settled. |
| 1007 | | X | | | | |
| 1008 | | X | | | | Settlement at front apron. |
| 1009 | | | | | X | A/C unit is settled. |
| 1010 | | | X | | X | Settlement at rear rock area, cracking in driveway. |
| 1012 | | | X | | | |

CYPRESS DRIVE

| STREET ADDRESS | FRONT STOOP | FRONT ROCK AREA | TRASH AREA | REAR STOOP | REAR WALK AT PATIO | REMARKS |
|---|---|---|---|---|---|---|
| | | | | | | |
| 6401 | X | | | X | | |
| 6403 | | | | | | Settlement at fence between 6405 and 6403. |
| 6405 | X | | X | | X | Settlement at fence between 6405 and 6403. |
| 6407 | X | | | X | | |
| 6408 | R | | | X | | |
| 6409 | X | | | | | |
| 6410 | X | | | X | | |
| 6411 | | | | | | |
| 6412 | X | | | X | X | |
| 6413 | X | X | | | | |
| 6414 | X | | | X | X | |
| 6415 | X | X | | | | |
| 6501 | X | | | X | X | |
| 6503 | X | | | | X | |
| 6505 | X | | | | | |
| 6507 | X | X | | | X | Garage stem wall is settling. |
| 6508 | | | | | | |
| 6509 | X | X | | | | Front apron is badly settled and need immediate replacement |
| 6510 | X | | | | X | |
| 6511 | X | X | | | X | Front apron is badly settled and need immediate replacement. |
| 6512 | X | | | | X | |
| 6513 | X | X | | | | |
| 6514 | X | | | | | |

(54038, R4, tab 33)

157. On 2 November 2000, ARC replied that it had replaced 36 stoops and that it would continue to perform repairs, weather permitting. ARC stated that the stoop repairs were not warranty work and that it expected to be paid. (App. supp. R4, tab 1049)

158. On 3 January 2001, ARC advised the CO that it was suspending stoop replacement due to bad weather (53723, R4, tab 40).

159. On 30 January 2001, the CO advised ARC that she was "very concerned about the severe safety hazard that exists at locations where the stoops have settled from 6 inches to over 14 inches." She stated that concrete had been placed nearly every workday in January and directed ARC to submit a plan to correct this hazard by 2 February 2001. (R4, tab 41)

160. On 31 January 2001, the CO forwarded a copy of the government's drainage survey to ARC, stating that the soil around the M2 buildings was exhibiting unacceptable consolidation due to poor compaction. The CO directed ARC to provide a plan to achieve positive drainage by 7 February 2001. (R4, tab 42)

161. On 2 February 2001, ARC replied that it was remobilizing to replace and/or lift sinking concrete items (R4, tab 43).

162. On 6 February 2001, TD&H provided a report of its review of Maxim's compaction test reports for phases I and II to LPW (the Title II inspector). TD&H found that Maxim took 2,003 tests (excluding retests) between 23 April 1998 and 20 September 1999, but that only 158 tests (excluding 2 retests), or 2.2 compaction tests per building, were taken in the foundation backfill. Maxim did not take any compaction tests in the foundation backfill around 26.7 percent of the buildings. Of the total 160 foundation backfill compaction tests, 83 tests or 51.9 percent were at subgrade or within 1 foot of finished grade. Excluding the 21 tests that did not identify the test depth and the 188 tests taken at footing grade for garages and porch footings, 1,055 tests, or 85.6 percent of nonfooting tests, were taken at subgrade or within 1 foot of final grade. TD&H affirmed its 7 August 2000 conclusion:

> Our opinion remains that the settlement and the related damage are the direct result of insufficient compaction of the foundation backfill soils adjacent to the basement foundation walls.

(53723, R4, tab 43a at 4)

163. In his deposition, Mr. Juel of TD&H testified that if Maxim's compaction test reports had been timely submitted, it would have provided an alert to the government that testing was insufficient and that more tests were needed throughout the full depth of the backfill (ex. G-9, Juel dep. at 392).

164. At the 7 February 2001 PMR meeting, ARC stated that four stoops had been prepped and that it would begin repairs the following week (R4, tab 45). On 16 February 2001, ARC submitted a repair schedule for eight stoops. The schedule indicated that "the 4 bedroom units and the rear stoops [were] currently being evaluated" and that the proposed methods for those units "w[ould] be submitted...for approval before any repair action is taken." (R4, tab 46)

165. On 21 February 2001, ARC notified the government that it was ready to start repairing the front stoops (R4, tab 47).

166. On 5 March 2001, the CO again requested the as-built drawings (R4, tab 48).

167. In March 2001, ARC began repairing the front stoops using the "temporary" solution it had submitted on 13 July 2000. On 6 April 2001, the CO directed ARC to advise her by 9 April 2001 as to whether the "temporary" solution for repairing the front stoops would be the "permanent" solution. If the solution was only temporary, the CO directed ARC to submit its permanent solution by 9 April 2001. In the same letter, the CO directed ARC to submit a permanent stamped fix for the back stoops and grading by 9 April 2001. On 9 April 2001, ARC indicated that it was attempting to obtain a stamped plan for the front stoops, that the repair plan for the four-bedroom front stoops was still under consideration, and that it hoped to submit its plan by the end of April 2001. (53723, R4, tabs 49, 50)

168. On 30 April 2001, ARC submitted a stamped copy of a fix for the rear stoops and asked that the deadline for the rest of the plan be extended to 30 May 2001 (R4, tab 50A).

169. On 14 May 2001, the CO commented on ARC's proposed front stoop fix and requested resubmission by 22 May 2001 (R4, tab 51).

VIII. Termination for Default

170. On 17 May 2001, approximately 20 government representatives, including Ms. Rounsavill, met to discuss three ARC contracts, including the M2 and M3 contracts. Col John S. Graham, Commander, MAFB, thought the base "should get ARCC off-site, take them to court, and have the court backcharge them for corrections." (App. supp. R4, tab 1173 at 1, 5) With respect to the M2 and M3 contracts, the attendees agreed to pursue a two-pronged approach: (1) to try and get ARC to correct the work; and (2) to submit a funding request for a government-prepared repair plan in the event that ARC did not correct the work. They agreed that work on the contract would stop on 1 July 2001. (App. supp. R4, tab 1173 at 5, tab 1211)

171. Following the meeting, Mr. Cole asked Col Graham to submit a "letter of urgency." On 27 June 2001, Col Graham prepared a letter stating that it was urgent to address the deficiencies in the work during the current construction season and requesting that AFCEE identify an appropriate course of action, including legal remedies, to hold ARC accountable. (App. supp. R4, tabs 1202, 1215 at 2)

172. On 31 May 2001, the CO approved Strobel Architects & Consultants, ARC's new A/E (53723, R4, tab 52).

173. On 11 June 2001, the CO issued a "Warranty of Construction" letter to ARC, which stated, in part, as follows:

> 2. The Air Force has given ARCC numerous notices of the stoop problems on the subject contract which were considered under warranty and to be a safety hazard for the families living in the units with possible structural damage. A walk through with the Air Force Title II Inspector-Ron LaRue, ARCC-Robert Berger/Rick Rardon and the Base C.E./Sgt Pruitt was completed of the units in Phases 1 & 2 the first 2 weeks of April 2001. Attached is a copy of the survey completed as a result [of] the walk-through.
>
> 3. The government reviewed ARCC['s] proposed design for the stoop repair received on 30 April 2001 and requested a redesign addressing issues stated in AF letter 14 May 2001. ARCC has continuously failed to provide a stoop replacement that would meet the government's approval along with [a] plan to correct the soil subsidence issues.
>
> 4. The Government has given ARCC a reasonable time for ARCC to respond with a workable fix for the soil subsidence and the sinking stoops since our first request on 01 Nov 00 with the 1st survey attached.
>
> 5. ARCC recently responded on 01 Jun 2001 with notification that a new Architect firm will be designing corrective actions for each situation, with minimal disruption to the residences. ARCC neglected to give the Government a date when these designs would be received and warranty work would begin. ARCC has failed to submit (1) a comprehensive plan, (2) concept scenarios, (3) suitable construction drawings and specifications for soil subsidence around the units by a registered A & E firm, and (4) a milestone schedule with a detailed work performance to fix the drainage problem this construction season.
>
> 6. The current drainage conditions around every unit ARCC constructed under the subject contract is likely to be structurally harmed due to the expansive soils on which these units are built if the drainage issues are not corrected this construction season.

> 7. The winter construction exclusion season begins on 01 Nov 01. This date also marks the end of a realistic construction season. If the government must proceed with an alternative plan, ARCC and its sureties shall be liable for any costs incurred by the Government in completing this warranty work. No additional payments shall be processed on the subject contact [sic] until this warranty work has been completed and the government has received the "As-Built" drawings.
>
> 8. Attached are the results of the walk-thru completed 2nd week of April 2001. You are directed to reply by 20 June 2001 with your corrective actions (reference paragraph 5 above).

(53723, R4, tab 54)

174. On or about 28 June 2001, Mr. Gary Erickson, AFCEE's Civil Engineer, met with Ms. Rounsavill and others. Mr. Erickson stated that the marching orders from Col Carmody/Space Command and Col Deppe, Wing Commander, were to terminate ARC and get them off the base, preferably by July 2001. (App. supp. R4, tab 1219)

175. On 10 July 2001, Ms. Rounsavill suspended work on the M2 contract indefinitely "due to your [ARC's] failure to provide an acceptable solution to the stoop replacement and soil subsidence issues and 'As-Built' drawings. You have not provided a comprehensive plan for correcting the sinking stoops, soil subsidence and drainage problems." (53723, R4, tab 56)

176. On 11 July 2001, Mr. Dethloff advised the CO that there had been a severe water saturation problem at the site over the past 18 months. In his view, the government was responsible for these problems because Amendment No. 0004 "deleted possible items which [might have] prevented this condition from happening, just to meet its CCL budget." (53723, R4, tab 57)

177. On 26 July 2001, ARC and the government met to discuss the M2 and M3 contracts and another ARC contract that had apparently been terminated. With respect to the M2 contract, the government took the position that ARC was responsible for the design because it was a design/build contract. ARC took the position that it had given the government "the product they wanted and it didn't work." With respect to the M3 contract, the parties disagreed over the grading requirements. The meeting adjourned without resolution of these issues. (53723, R4, tab 59)

178. On 7 August 2001, Mr. Dethloff submitted an unstamped stoop repair plan, stating that ARC would repair the rock gardens, prepare the drawings for the sinking stoops, and install helical piers under the garages (as per past installations) with the understanding that those items were "Chargeable" to the government (53723, R4, tab 60; tr. 7/139-40).

179. On 31 October 2001, Ms. Rounsavill issued a show cause notice to ARC, which stated, in part, as follows:

> 2. The Government is considering terminating for default Contract F41622-97-C-0022...based on breach of warranty and latent defects....
>
> a. Despite continuous requests[,] ARC has failed to...provide an acceptable method of repair for the serious and recurring problems with the stoops and garages, and for the improper drainage... ARC was provided every opportunity to discover the...cause of the problem, provide an acceptable repair, and accomplish repairs.... ARC failed to do so. This... constitutes a breach of the warranty of construction.
>
> b. ARC has failed to provide the [as-built] drawings....
>
> c. ARC failed to construct the houses in accordance with the design and specifications...and [the work] is not free of defects in equipment, material, or design furnished, or workmanship performed by ARC [or its] subcontractor[s]. Investigation of sinking stoops and garages after acceptance led to the discovery of improperly compacted soils and use of improper fill materials. [T]he damage now appearing inside the houses indicates the possibility of further latent defects... As a...result of the[se] latent defects[,] the houses are exhibiting significant damage...including but not limited to the following:
>
> 1) Soil subsidence in backfill around...foundations
> 2) Improper (negligible to non-existent) drainage
> 3) Heaving and settlement of sidewalks

4) Cracking in the foundations of the houses
5) Differential Settlement and heaving of stoops
6) Large cracks in drywall and separation/breaking of drywall inside the homes
7) Twisting of some walls in the houses
8) Differential movement in the basements
9) Sink-holes in the road/uneven pavement throughout housing area
10) Garage roofs separating from the house roofs
11) Settlement and heaving of patio foundations and steps

....

4. [In order to determine] whether your failure to perform arose from causes beyond your control and without fault or negligence[,] you are [requested] to present, in writing, any facts and accompanying substantiation bearing on the question...within 10 days after receipt of this notice.... Your failure to present any excuses within this time may be considered as an admission that none exist....

(53723, R4, tab 62) ARC did not reply to the show cause notice.

180. On 19 December 2001, Ms. Rounsavill revoked acceptance and terminated the contract for default, alleging breach of warranty and latent defects. Among other things, she asserted that ARC had failed to "accept responsibility or to provide an acceptable method of repair for...the stoops and garages" and that it had failed to submit the as-built drawings. She also alleged that during the government's investigation of the defects, it had discovered that ARC failed to properly compact the soils and used improper fill materials, resulting in significant damage. (53723, R4, tab 63)

181. Ms. Rounsavill testified that she based her final decision on "all the information" she had, including the documents referenced in her decision (tr. 2/122). She described the status of the work at termination as follows:

> We had…stoops beginning to sink. Visually you could see this.
>
> We had sidewalks begin to crack. We began to see this in Phase I and II.

....

Q. Did you notify [ARC] about these problems?

A. Numerous times. Through meetings, through letters, through telephone calls, through teleconferences with the program managers at the Base, and ARC's program managers. And numerous, numerous letters.

Q. And what was ARC's response to all of your requests and your correspondence?

A. They were working [on] it.

And I requested [them] to give me a fix for the stoops. They gave me a temporary fix. I wanted a...final fix. I wanted drawings from...their architect of record with their seal that it would work. And I asked for that numerous times.

They kept coming back to me [saying] "they're working on it and they will get it".

I asked for test reports on the pourings of the concrete numerous times, and they kept saying "they're working on it; they'll get it".

I asked for as-builts...so [that] if we had to do something...[we] knew where the sewer lines were running; we knew where the telephone cables were going and knew where the gas lines were going. And we didn't get them.

....

Q. So, you never received them?

A. Not from ARC.

(Tr. 2/111-14)

182. When asked if the termination decisions were hers, she testified as follows:

A. They're my final decision.

> Based on all the information I ha[d] accumulated and based on recommendations from other parties within the Air Force and based on the procedures that I followed through the FAR, I made that final determination.
>
> Q. You had the final call, correct-
>
> A. That's correct.

(Tr. 2/200-01)

IX. M3 RFP

183. On 6 March 1998, the government issued RFP No. F41622-97-R-0029 for a design/build (turnkey) for phase III (54038, R4, tab 1). The RFP included a "COMPREHENSIVE STATEMENT OF WORK FOR REPLAC[ING] FAMILY HOUSING [FY98]" (SOW), dated 26 September 1997, 15 percent conceptual drawings, and a preliminary geotechnical report prepared by TD&H dated October 1997 (54038, R4, tabs 1, 3C; ex. G-1 at 1).

184. The SOW provided, in part, as follows:

> 7.2.1 CONTRACTOR SOIL AND FOUNDATION REPORT: A soils and foundation report...shall be furnished...by the Contractor.... This report shall be prepared by a licensed professional engineer, experienced in soil mechanics and expansive soils of the area and shall certify to the adequacy of the soil and foundation aspects of the design, including, but not limited to:
>
> 1. Earthwork construction
> 2. Cut and fill slopes
> 3. Streets
> 4. Surface and subsurface drainage
> 5. Erosion and siltation prevention...
> 6. Foundation stability
> 7. Settlement or heave
>
> ... All organic material shall be considered deleterious and unsatisfactory for use on this project.

7.3 SOIL COMPACTION: Soil compaction shall be achieved by approved equipment well suited to the...soil being compacted. Material shall be moistened or aerated as necessary.... Compact each layer to not less than the percentage of maximum density specified below, determined in accordance with ASTM D 1557.78 Method B or D:

**TABLE 7.3: SOIL COMPACTION REQUIREMENTS**

| **Subgrade Preparation, Fills, Embankments, and Backfill** | **Compaction Requirements (% of Maximum Density)** |
|---|---|
| Under structures, building slabs and paved areas and in trenches under pipes beneath concrete slabs on grade. | 95% |
| Under sidewalks, patios, and other miscellaneous slabs. | 90% |

Note: These compaction requirements shall be modified as recommended by the Contractor's soils report if the native soils so dictate.

....

9.2.2 SURFACE STORM DRAINAGE: Provide drainage away from all buildings on all sides with a minimum slope of 8 inches in 10 feet, for a minimum of 30 feet....

....

12.4.1 FOUNDATION DESIGN: The foundation shall be designed in accordance with the Contractor's Geo-technical Survey Report.

(54038, R4, tab 1, SOW, chapter 1 at 12, 22, 31)

X. M3 Contract

185. On 27 March 1998, the government awarded Contract No. F41622-98-C-0011 to ARC in the amount of $11,627,000 (54038, R4, tab 1). The work consisted of the "design and construction of complete and usable permanent structures consisting of all labor, consultant services, materials and equipment and all necessary site improvements, and structures and off-site work (utilities, roads, etc.) as may be required for the construction of 72 new family housing units," the demolition of 64 existing units and 15 garages, and abatement of hazardous materials (R4, tab 1, SOW, chapter 1 at 1). The SOW indicated that "**the Government wishes to maintain compatibility with the housing units being constructed** [under the M2 contract]" (*id*. at 4) (emphasis in original).

186. The contract incorporated by reference FAR 52.236-5, MATERIAL AND WORKMANSHIP (APR 1984); FAR 52.246-12, INSPECTION OF CONSTRUCTION (AUG 1996); FAR 52.246-21, WARRANTY OF CONSTRUCTION (MAR 1994); and FAR 52.249-10, DEFAULT (FIXED-PRICE CONSTRUCTION) (APR 1984) (R4, tab 1).

187. EJCA signed and sealed the plans and specifications for phase III on 14 April 1999 (54038, R4, tabs 28, 98). The design for phase III was very similar to that of phases I and II. The design required SOG construction with full basements supported by trench footings extending from 7 to 10 feet bgs. The garage footings were approximately six feet bgs and supported by compacted fill. The garages were rigidly attached to the buildings and were filled with compacted fill up to the level of the subgrade. Each unit had a bearing beam in the center to support the first floor construction. The bearing beam was supported by interior adjustable steel post jacks bearing on isolated spread footings. Unlike the design for phases I and II, an exterior PFD was to be placed at the base of the footings (*see* findings 20, 193). Just as with phases I and II, the plans indicated that the basement stairway was connected directly to the basement floor slab and ¾-inch Simpson clips were used instead of slip joints. The plans also required a slope of 8 inches in 10 feet to allow for adequate drainage away from the foundations.

188. Paragraph 3.01 of specification section 01000, "GENERAL REQUIREMENTS," indicated that the government would provide a Quality Assurance (Title II) inspector who was responsible for insuring compliance with the plans and specifications. The inspector did not have authority to direct or stop work. Paragraph 3.03C. required submission of the as-built drawings within 30 calendar days of the final inspection. Paragraph 3.16 of that section, "QUALITY CONTROL," provided as follows:

> **A. ...THE GENERAL CONTRACTOR AND SUBCONTRACTOR IS RESPONSIBLE FOR QUALITY CONTROL WHICH IS CONSIDERED BY THE GENERAL CONTRACTOR AND THE**

> **GOVERNMENT TO BE A MAJOR INSPECTABLE ITEM OF THIS CONTRACT**....
>
> ....
>
> **C. Quality Control Plan [QCP]**: Prior to the start of construction, the [QCP] must be accepted by the [CO]....
>
> ....
>
> **D. Acceptance**: ...Non-compliance with the [QCP] will result in appropriate action by the General Contractor.
>
> **E. Quality Control Records**: The [QC] Records shall contain a record of daily inspections for all work accomplished.... A copy of the daily reports shall be given to the project inspector and project CQC.

(54038, R4, tab 28) (Emphasis in original)

189. Unlike the QC plan in the M2 contract, the QC plan for the M3 contract authorized ARC's QC manager "to direct the removal and replacement of non-conforming work." The test plans in the QC plans were identical:

> ONE TEST EACH 2000 SQUARE FEET OF EACH 8 INCH LIFT, AND AS REQUIRED TO VERIFY PROPER BACKFILLING OF STRUCTURES AND CONFINED AREAS. EACH LAYER AND SUBGRADE, MIN. 2 TESTS.

(R4, tab 1079 at B009765, B009783)

190. Specification § 01420, "QUALITY CONTROL," stated, in part, as follows:

> **1.08 EARTHWORK FIELD OBSERVATION AND TESTING**
>
> A. An independent testing laboratory...shall be retained ...to perform all testing and observation for earthwork....
>
> ....

C. [Non-compliant items]...shall be...immediately brought to the attention of the General Contractor and [CO]....

....

E. Employment of testing laboratory shall in no way relieve the General Contractor/subcontractor of his obligation to perform work in accordance with the Contract Documents.

....

G. Frequency of Tests: The frequency of tests shall be sufficient to ensure reasonable coverage of the work.... As a minimum, the following test frequency shall be implemented:

| Earthwork | Frequency |
|---|---|
| 1. Compaction Testing. | A soils technician on-site...to observe... and perform density testing. |
| 2. Determine suitability of soil.... | As required. |
| 3. Perform laboratory moisture-density relationship curve (proctor).... | Each proposed fill material. |
| 4. In-place density and moisture content of structures and confined areas. | One test per 2,000 square feet of each 36 inch lift, plus as required to verify proper backfilling |
| .... | |
| 6. Foundations. | A Soils Engineer to...observe bottom of footing excavations...to… verify suitability of bearing soils.... |
| 7. Pipe Trenches. | A Soils Engineer is to observe trench excavation and backfill.... |

H. Test Reports: Promptly submit reports of each day's inspections and tests including:

....

11. Observations regarding compliance with Contract Documents...shall be made directly to the General Contractor with copies to the Government.

(54038, R4, tab 28)

191. Specification § 02200, "EARTHWORK," provided, in part, as follows:

**3.01 METHODS**

A. All earthwork shall be in accordance with the geotechnical report, by Maxim...dated 21 July 98, and by supplemental report dated August 1998.... Fill should be placed in uniform lifts of a thickness suitable for the compaction equipment selected, and compacted to a density as specified below throughout its full depth. Moisture conditioning may be necessary to achieve the specified compaction. Moisture content shall be within two percent (2%) of optimum. Compaction shall be determined by ASTM D698.

1. Under structures, building slabs, paved areas and in trenches under above areas: 95%.

2. Under patios, sidewalks and other miscellaneous slabs: 90%.

3. All other areas of site: 90%

4. Perched water in sandy or silty soils may be encountered[.] [W]here saturated clays are found in the building footing and utility trench areas, excavate saturated material and backfill with compacted material, gravel, or lean concrete as directed by the soils engineer.

> Soil fill shall not be frozen.... If fill is frozen or softened after placement, [it] shall be reconditioned and recompacted.
>
> ....
>
> E. Test: Tests shall be in accordance with Contractor's Construction Quality Control and Testing Plan.

(54038, R4, tab 28)

192. Maxim's 21 July 1998 report is not in the record. However, Maxim's August 1998 report (Maxim report) indicated that fat clay was not suitable for use as fill material around foundations and basement walls, but that the silt, silty clay, silty sand and lean clay found at the site could be used. Maxim recommended that surface grades be developed to provide positive drainage of surface and roof runoff, that roof drainage be discharged at least 10 feet away from building perimeters, and that 10-mil polyethylene sheeting be placed below the exterior finished grade. To reduce floor slab movement, Maxim suggested that (1) floor slabs be separated from all bearing walls and columns with expansion joints; and (2) interior non-bearing partitions (including stairways) resting on floor slabs have slip joints that would allow at least 2 inches of vertical movement. Maxim stated that it was important to control moisture. If the government was unwilling to accept the risk of slab movement, Maxim recommended that a structural floor system be used. (R4, tab 147)

193. In January 1999, ARC requested Maxim to clarify two of the recommendations in its July 1998 geotechnical report (R4, tab 152). On 18 February 1999, Mr. Jeremiah B. Bowser, Maxim's engineering manager, provided the requested clarifications. With respect to the second recommendation, which related to ARC's plan to overexcavate and place structural fill, he made three recommendations: (1) that a minimum of two-feet of structural gravel fill be placed beneath the footings and that the entire excavation subgrade be sloped at a minimum 2 percent grade to drain toward the sump or foundation; (2) that the PFD be lowered to the base of the footing excavation; and (3) that the sump be perforated for that part in contact with structural gravel fill to permit drainage as directed by Maxim's letter of 28 September 1998. (R4, tab 153, *see also* tab 150)

194. Ms. Rounsavill succeeded Mr. Vaughn as CO on 26 February 1999 and was the CO through termination of both contracts.

195. Capt Miller was the PM for most of the M3 contract. Mr. David Cole became the PM in September 2000. Mr. McMahon was the Title II inspector. Mr. Klevberg was Maxim's soils engineer, and Mr. Jones and Mr. Scott Vosen, an engineering technician with Maxim, performed the testing. The contract stated that only the CO had authority to change the contract (54038, R4, tab 1, chapter 3 at 57).

196. By the time work began, the relationship between Mr. McMahon and ARC was very contentious. Mr. Gauvin, ARC's foreman for most of both contracts, pulled a knife, flipped it open, and held it against Mr. McMahon's throat "a few times" in an attempt to intimidate him. As Mr. McMahon put it, "[h]e was good with a knife." (Tr. 9/137-40) Mr. Kent Schlotter, ARC's PM, told Mr. McMahon that he would "bury" him (tr. 4/68-69, 9/142). In addition, Mr. Anthony Cattaneo, ARC's superintendent, told "untruths" about Mr. McMahon and ultimately got him thrown off the job (R4, tab 1261; tr. 9/142-43).

XI. Performance of the M3 Contract

197. Work on the site began in June 1999 (R4, tab 590).

198. On 13 July 1999, Mr. Klevberg recommended to ARC that it take the following steps to prevent settlement problems in phase III: (a) keep overexcavation to a minimum; (b) insure that compaction meets the required standards; and (c) keep as much water as possible away from the foundation (R4, tab 849-8; ex. G-11, phase III, hole 4).

A. Satisfactory Fill Material

199. On his project report for 4 October 1999, Mr. Jones stated as follows:

> [The] finish fill on garage slab grade contained trash and organic materials. I suggested this shouldn't be allowed.... This is located on Hole # 5 garage areas (both sides).

(R4, tab 709 at 6)

200. On his project report for 13 October 1999, Mr. Jones reported that the base course material for the finish grade of the left slab at hole #8 was contaminated with organic material and top soil. He "pointed this out...and hinted that ARC should remove this contaminated fill material. Nothing was done." (R4, tab 717 at 5)

201. On 23 November 1999, Mr. Jones reported "2½' diameter clump of dirt clods...at the 4' B.G. [below ground] level" in the garage slab fill at hole 18B (R4, tab 750 at 5).

202. Test pit TPO6-05 (1109/1111 Jasmine Court), one of two test pits excavated in phase III by URS, the government's geotechnical firm, revealed 2-inch by 4-inch boards buried in the backfill at a depth of 6 to 8 feet (ex. G-1, § 5.4.6.1 (revised)).

B. Lifts

203. On 14 July 1999, Mr. Jones noted the following:

> Sewer trenches - Between MH [manhole] 7 & 8 at Cypress.
> -16' to pipe bedding
> -lst lift 8' [A]fterward lifts were placed at 2½ -3' lifts. Density testing was conducted at these levels. This was mentioned to Chuck [Gondeiro], ARC-QC.

(R4, tab 603 at 5)

204. Following a 5-6 August 1999 site visit, Mr. Carlin advised Soltek that he "[was] concerned about the backfill methods currently used by [ARC]," sending Soltek seven "thumbnail" photographs of the work. The copies of the photographs in the record are black and white and are illegible. Photograph #2 (AF 021933) is labeled "No Compaction"; photograph #3 (AF 021934) is labeled "No Compaction in Lifts"; and photograph #4 (AF 021935) is labeled "No Compaction." (R4, tab 1349) On 27 August 2004, the government moved to compel full-sized color copies. Although the Board granted the motion, ARC did not produce the photographs (gov't br. at 69). As a sanction, we draw the adverse inference that ARC failed to properly compact the utility trenches in the M3 contract.

205. On 26 August 1999, Mr. Schlotter wrote Maxim as follows:

> There has been considerable concern brought to [ARC's] attention regarding the height of the lifts and deep compaction in the utilities trenches on the M3 project…. [P]lease provide us with Maxim[']s requirements for maximum lift heights....

(R4, tab 154)

206. Mr. Klevberg replied as follows on 30 August 1999:

> For the clay soils commonly encountered on the project site, compaction requirements can be readily achieved for moisture-conditioned fill placed in 8 to 12 inch thick lifts using typical compaction equipment.

(R4, tab 155)

207. Following a site visit on 1-2 September 1999, Mr. Carlin advised Soltek that he was "very concerned about the CQC Program" and that there were "a number of issues involving footing placement [and] backfill operations (both utility and building) that [he] felt were not being addressed properly" (R4, tab 1384).

208. On 15 September 1999, Mr. Gondeiro issued a noncompliance notice to J&K because the lifts used to fill a trench near Cypress Drive were "too deep" and proper compaction had not been verified. He wrote that "J&K must ensure compaction in lifts." J&K ultimately removed the backfill and replaced it in 3-foot lifts. (R4, tab 851-13)

209. On 28 September 1999, Mr. Jones reported the following:

> Concrete placement began at 800 am for Hole #8 walls.... [The subcontractor] indicated [that ] the walls in Hole #8 and FTGs for Hole #10 were the only scheduled placements for today..... About 1 hour later, I noted the pump truck at Hole 11.... I decided to investigate. The FTG for hole #12 was over ½ placed. I semi-politely told [LCC] I need to know your concrete schedule. The reply: "You mean you didn't know about the 2nd FTG pour." Within hearing distance was Chuck [Gondeiro] (ARC-QC). His input: "You mean we didn't tell you about the second FTG pour?"

(R4, tab 705 at 5)

210. On 20-21 October 1999, Mr. Carlin advised Soltek of the following concerns:

> Based on our current soil problems on the Phase Two Project, I am...very concerned about the methods currently being used during the backfill operations.

(R4, tab 1472)

211. As was the case with phases I and II, there is no evidence that the CO approved any change to the eight-inch lifts specified by the contract.

C. Compaction

212. On 28 September 1999, Mr. Jones reported that:

> Hole #5 left Garage slab fill failed density at 5' B.G. They (ARC) instructed the ARC fill crew to add about 1'...of "good material" and recompact. Fill crew did as directed. Area pass test, but at 1' higher grade.

(R4, tab 705 at 5)

213. On 4 October 1999, Mr. Jones reported the following:

> Hole #10 Floor slab subgrade (10" fill from FTG grade to top of FTG) was not compacted. Density tests proved the point. However, since PCV plumbing was in place compacting all around areas of the slab subgrade fill was impossible without damage to PCV drain pipes. Basically only ½ floor slab subgrade was compacted; the remaining ½ wasn't compacted. This applies to both the left & right units for hole #5.

(R4, tab 709 at 6)

214. During the M3 contract, Mr. McMahon observed that some of the utility trenches were "backfilled at a thicker rate than they should have been" and was of the opinion that not enough compaction testing was being performed (tr. 9/103, 132-34).

215. Although Mr. McMahon side-stepped a question about undercompaction at the hearing, he testified during his deposition that ARC failed to rework undercompacted soil on numerous occasions during the M3 contract:

> [Q.] On the M3 project, did you observe any failure to rework undercompacted fill?
>
> ....
>
> [A.] ...Numerous occasions.
>
> ....
>
> Q. Tell me about those.
>
> [A.] They tried to build the grade up around the units to comply with their plans and specs originally drawn. And

> there w[ere] large amounts of dirt dumped on top of the surface to try to bring the grade up.
>
> ....
>
> [Q.] And does that, in your view, constitute a failure to rework undercompacted fill?
>
> ....
>
> [A.] There was never any compaction or very little compaction put on this fill.

(Tr. 9/156-59, 163-64)

216. On 5 October 1999, Mr. Jones reported the following:

> Hole #5, garage slab fill (grade) failure. [ARC moisture conditioned] the fill material, but [it] didn't compact. A retest of the area confirmed non compaction. At 130 pm rebar was in place over the failed areas with concrete placement scheduled for tomorrow. Failed area was again mentioned to [ARC].

(R4, tab 710 at 5)

217. On 7 October 1999, the driveway fill material at hole #6 failed. Mr. Jones noted that the "area was retested, but about 1' of fill was added over the original test point," invalidating the retest (R4, tab 715 at 7).

218. On 11 October 1999, Mr. Jones stated that the fill material at the hole #6 driveway had failed the density test on 7 October 1999. He stated that "[t]he area was retested, but about 1' of fill was added over the original test point." (R4, tab 715 at 7)

219. On his daily report for 7 December 1999, Mr. McMahon stated that he had "some concern regarding the compaction on Hole #25 and #26" (app. supp. R4, tab 1428 at 95).

220. On his project report for 26 June 2000, Mr. Vosen noted the following:

> Ran densities, reported results [to ARC]. Checked the densities on the sidewalks around unit 29-A[.] Very low

> densities. Suggested [to ARC] that re-packing these areas would be prudent.
>
> Retested failing sidewalk areas. Along the house improved, but in front of the steps did not. Gene [Frederick] said they would pour regardless.

(R4, tab 810 at 5)

221. Mr. Vosen's project report for 29 June 2000 stated as follows:

> Took compaction test on driveway 31-B. Sidewalks (next to garage & below front steps) had not been compacted. Contractors couldn't locate plate whacker at first. Compacted sidewalk next to garage, but Gene [Frederick] started the pour onto the sidewalk below the steps just as the plate whacker showed up to compact it.

(R4, tab 813 at 3)

222. On 5 July 2000, Mr. Vosen reported the following:

> Took more compaction tests on 2 sidewalks (had been filled to final grade & compacted since this morning). Both failed by a large margin, but pouring had already begun over them.

(R4, tab 814 at 4)

223. On his project report for 13 July 2000, Mr. Vosen reported as follows:

> Nothing ready for pour. Working on forming curbs in front of 35 A & B. Also forming sidewalks lining west side of Cypress Dr. Ran densities back and forth as they got them backfilled and compacted.... All densities came back low. Told Gene [Frederick], but he said they'd pour anyhow – already running late.

(R4, tab 819 at 4)

224. On his project report for 20 July 2000, Mr. Vosen noted the following: "Ran densities on sidewalk at 35-B, C-Court.... Both densities were low – poured anyhow." (R4, tab 824 at 3)

225. On his project report for 24 July 2000, Mr. Vosen wrote: "Tested for compaction. Under 90% in one area, almost passed in another. Reported to Gene [Frederick], he said he'll pour anyhow." (R4, tab 825 at 4)

226. At the 21 August 2000 PMR meeting, settlement in the area of hole #4 and negative drainage at two units were discussed (app. supp. R4, tab 996 at 2).

D. Overexcavation

227. ARC maintains that, with the exception of one hole allegedly overexcavated by mistake, "there was no over-excavation on M-3" (app. br. at 68). However, both of the test pits excavated by URS against the foundation walls in phase III (TPO-05 and TP11) had gravel beneath the footings (ex. G-1, § 5.4.6.1 (revised)).

E. Perimeter Foundation Drain

228. Despite the fact that ARC asserted that it lowered the PFD to the base of the footing, the PFD in one of the two phase III test pits excavated by URS (TP11) was placed on top of the footing (ex. G-1, § 5.4.6.1 (revised)).

F. Dewatering

229. On his project report for 30 June 1999, Mr. Jones reported the following:

> [Subcontractor] cancelled concrete placement due to light rain. Rain is expected to increase in the afternoon. However, [subcontractor] will continue to set forms and place gravel fill.

(R4, tab 590 at 4)

G. Quality Control Reports

230. As with the M2 contract, ARC did not submit its quality control reports for the M3 contract to Mr. McMahon. They were, however, apparently available for his review in ARC's job site trailer (tr. 4/198-99). Capt Miller did not recall seeing any QC reports and was not aware that they were not being submitted (ex. A-6 at 47).

H. Compaction Test Reports

231. Mr. McMahon was concerned about the failure to receive the compaction test reports because he did not believe that compaction was being done properly.

According to Mr. McMahon, the failure to receive compaction test reports was a “red flag" to the inspectors. (Tr. 9/130)

232. Between 29 September and 1 October 1999, Mr. Jones listed 30 failed density tests that had yet to be retested in his project reports (R4, tab 706 at 5, tab 709 at 7).

233. On 14 July 1999, Mr. Jones noted the following on his project report:

> The failed density test (water line trench) resulted in 88.5% compaction. J&K crew was advised to reroll the area. He did, but 45 mins later the area was being filled to grade with soils. There can be no retest for this failure.

(R4, tab 603 at 5)

234. ARC failed to submit Maxim’s compaction test reports for the M3 contract to the government (R4, tab 1628).

235. The government did not receive the reports until the Board issued a subpoena *duces tecum* to Maxim for its documents on 21 October 2003 (gov’t br. at 104).

XII. Pre-Termination

236. At the 21 August 2000 PMR meeting, Capt Miller expressed concern about negative drainage around the foundations in phases II and III. In particular, negative drainage was observed at the two corner units on Court B in phase III. The meeting minutes indicate that low spots and pooling water in the yards were preventing occupants from mowing their backyards at the “West Side of FY 98 where it meets Phase III.” Ms. Rounsavill attended the meeting. (App. supp. R4, tab 996 at 2-3)

237. During his initial site visit on 11-12 September 2000, Mr. Cole was advised that the “[b]ase [was] having problems with compaction in all phases” (app. supp. R4, tab 528). At the M3 site, he observed “small signs” of subsidence, “an inch, maybe, or so” (ex. A-4 at 122-23, 160).

238. Following the visit, Mr. Cole requested Ms. Rounsavill to obtain copies of Maxim’s compaction testing reports so that he could “get a handle on...why we were having subsidence” (ex. A-4 at 159-60).

239. On 3 October 2000, Messrs. McMahon, Cole, Schlotter, and Smsgt Cleary inspected about 22 units in courts A and B. Mr. McMahon reported numerous areas of

negative drainage and ponding and noted that ARC had agreed to install area drains at two locations (app. supp. R4, tab 1026 at 2-6).

240. On 4 October 2000, the same individuals inspected about 31 units in B and C courts. ARC indicated that it might install an area drain at one location in B and C courts. (App. supp. R4, tab 1026 at 7)

241. On 16 October 2000, Mr. McMahon observed an inch of settlement at the front apron of 1005 Jasmine, 14 garbage enclosures that were out of level and a broken sump pump discharge line (app. supp. R4, tab 1428 at 384-88).

242. On 8 November 2000, Mr. McMahon observed a void under the apron of 1110 Hawthorn and a "bad" front apron on unit 14 (right side) (app. supp. R4, tab 1428 at 406).

243. On 16 November 2000, Mr. McMahon observed heave and a crack in the front apron of 1111 Jasmine Court (app. supp. R4, tab 1428 at 413).

XIII. Acceptance of the M3 Contract

244. Mr. McMahon accepted the M3 contract (except for landscaping and grading) in increments beginning on 28 September 2000 and ending on 21 November 2000 (app. supp. R4, tabs 1004-07, 1053, 1070).

XIV. Post-Acceptance and Termination for Default

245. On 10 July 2001, the same day she suspended work on the M2 contract, Ms. Rounsavill suspended the M3 contract (54038, R4, tab 51).

246. On 2 October 2001, Ms. Rounsavill partially terminated the landscaping and grading portions of the M3 contract for default. The appeal was dismissed as untimely on 23 June 2003. *American Renovation & Construction Co.*, ASBCA No. 54039, 03-2 BCA ¶ 32,296.

247. On 6 February 2002, the government, accompanied by ARC personnel, performed a visual survey of the units. Each deficiency was noted on a floor plan of that unit. According to Ms. Rounsavill, over 50 percent of the units showed some form of distress. (54038, R4, tab 71)

248. On 17 September 2002, Ms. Rounsavill revoked acceptance and terminated the remainder of the M3 contract for default alleging that ARC failed to complete the work in accordance with the plans and specifications, failed to perform the work in a

skillful and workmanlike manner, breached its warranty of suitability and its implied warranty of habitability. Ms. Rounsavill included a copy of the 6 February 2002 visual survey with the decision. (54038, R4, tab 71)

XV. Egress Window Drains

249. In 2003, the base responded to complaints about a wet basement and discovered that the egress window drains were only 12-inches long. In order to reach the PFD, they had to be 4 feet long (tr. 7/166-67).

250. In his comments from the 100 percent design review, Fire Chief John P. Gillespie indicated that ARC had agreed to include an egress window drain on its final drawings. The diagram he drew depicted a pipe extending from the floor of the egress window well to the PFD, about 44 inches below. For unexplained reasons, the egress window drain was not included on the final drawings for either contract. (54038, R4, tab 5, drawing A6.1 at detail 1; app. supp. R4, tab 37 at 22-23)

251. On 28 August 1998, ARC offered to install 4-foot drain pipes in all 122 units for $14,507 (app. supp. R4, tab 782 at 45; tr. 7/146). According to Mr. Dethloff, Ms. Rounsavill did not want to pay that much and reduced the length of the drain pipe to 2-feet (tr. 147). Ms. Rounsavill did not recall the details of the negotiation.

252. On 10 December 1998, the parties entered into bilateral Modification No. P00006, "[i]ncreas[ing] the depth of the existing rock and add[ing] a drain pipe in 122 units" at a cost $5,578. The modification did not state the length of the drain pipe. (R4, tab 12)

. 253. As a result of the fact that the drain pipes were too short to connect to the PFD, the egress window wells overflowed into 46 basements (tr. 1/91). None of the drain pipes extended to the PFD. Five basements developed the deadly *Stachybotrys* black mold (gov't br. at 4). Using its own forces, the government replaced the drain pipes in 180 units. The drain pipes in the other units were addressed as part of the PRP. (Tr. 1/94) ARC alleges that the work cost $37,000 (app. reply br. at 46). Since the installation of the new drain pipes, there have not been any more reports of wet basements in MMV (tr. 1/63-64).

254. On 5 December 2003, Mr. Dethloff signed the answers to Respondent's Second Set of Interrogatories and Requests for Production of Documents (phases I and II) under oath. Interrogatory No. 101 and Mr. Dethloff's reply were as follows:

INTERROGATORY NO. 101

> State what you allege the design was for drainage in the basement egress windows for the Project.
>
> ANSWER TO INTERROGATORY 101:
>
> In accordance with the design mandated by the Air Force, ARC excavated four feet below all egress window wells and placed three-quarter inch washed rock in the excavated area with a perforated four-inch PVC pipe in the center of the rock.

When asked if his reply was truthful, Mr. Dethloff testified as follows:

> A. I don't believe it was.
>
> Q. You're saying it was not truthful back them?
>
> A. Well, we didn't excavate four feet below the egress well window, no.

(Tr. 7/164)

255. On 15 October 2003, Mr. Dethloff provided unsworn answers to Respondent's First Set of Interrogatories (phase III). Interrogatory No. 67 was virtually identical to interrogatory No. 101 of Respondent's Second Set of Interrogatories (phases I and II). When asked if his answer to interrogatory No. 67 was truthful, he replied "[h]onestly, I don't recall reading this portion. I didn't read this portion." (Tr. 7/166-67)

256. We find as fact that ARC deliberately failed to provide 4-foot drain pipes for the egress window wells for the contracts.

XVI. Government Expert - Mr. John R. Kovski

257. The government called Mr. John R. Kovski as an expert witness in geotechnical engineering. Mr. Kovski is employed by the URS Group (URS) in Houston, Texas. He attended the University of Illinois where he was awarded a Bachelor of Science degree in civil engineering in 1974, a Master of Science degree in civil engineering in 1977, and a Master of Business Administration degree in 1979. Mr. Kovski specializes in geotechnical and environmental engineering and is a registered professional engineer in the states of Illinois, Texas, and Wyoming. He has had over 30 years of experience and has been qualified as an expert in geotechnical engineering on three occasions. (R4, tab 1761) He was retained by the government to conduct a forensic

investigation into the cause and extent of the distress in the housing units constructed by ARC and to recommend potential remedial measures (ex. G-1 at 3, ex. G-44 at 12).

258. URS prepared a report dated 20 January 2004 entitled "Assessment of Causes of Observed Distress, Military Housing Units, Phases I, II, and III" (ex. G-1). Based on surveys of visual observations in 2000 and 2001 provided by the government, URS categorized the level of distress in the project using the following criteria: (1) negative drainage and backfill settlement; (2) stoop settlement and displacement; (3) basement floor heave; (4) interior cracking, corner bead buckling, and nail popping; and (5) garage separation and movement. Units with four to five defects were classified as category A (severely damaged). Units with two to three defects were classified as category B (moderately damaged). Units with one defect were classified as category C (slight damage). Units with no damage were classified as category D (undamaged). (Exs. G-1 at 34-35, tables 4-1, 4-2, 4-3, G-44 at 14-15) At the request of the parties, the presiding judge conducted a site visit on 4-6 October 2004 and viewed the exterior and interior of 66 units in the M2 and M3 contracts (site visit DVDs, 1-8).

259. The level of distress in the 194 units in the project was classified as follows:

| Phases I/II | | Phase III | |
|---|---|---|---|
| A (severely damaged) | 16 | A (severely damaged) | 10 |
| B (moderately damaged) | 89 | B (moderately damaged) | 57 |
| C (slightly damaged) | 16 | C (slightly damaged) | 4 |
| D (undamaged) | 1 | D (undamaged) | 1 |
| | 122 | | 72 |

(Ex. G-1, tables 4-1, 4-2, 4-3)

260. URS selected 22 buildings (41 units) from the M2 and M3 contracts for its study, including 7 buildings that were classified as severely damaged, 11 buildings that were classified as moderately damaged, 3 buildings that were classified as slightly damaged, and 1 building that was classified as undamaged (ex. G-1, table 4-4).

261. URS drilled 56 borings in the backfill around the buildings. Borings on the sides of the buildings were taken within two to three feet of the building. Borings in the back and front yards were taken within four to five feet of the building. (Ex. G-1, figures 4-3 through 4-24, ex. G-44 at 19). URS also excavated eight test pits against the foundation walls, drilled eight borings through and beneath the basement floor and garage slabs, and installed nine deep piezometers (ex. G-1, ¶ 5.4.6.1 (revised 12/8/04), ex. G-44 at 38). Four basement borings and three backfill borings were later converted into shallow piezometers (ex. G-1 at 38, tables 4-3 through 4-24, ex. G-44 at 17-24).

262. Mr. Kovski summed up the causes of the distress as follows:

> It is my expert opinion that there was an inadequate design and construction of the foundation, inadequate foundation preparation to include mismanagement of water during construction, improper selection of foundation wall backfill, and that the backfill was inadequately compacted. All of these flaws combined to allow moisture to infiltrate the expansive foundation subgrade soil causing that soil to swell, which caused the basement slabs to heave. Because the structural design placed structural elements on the basement slabs, once the slabs heaved, the upward pressure was transferred from the slab to the walls, stairway and ultimately to all levels of the structure. Once that...occurred, those elements of the structure began to move differentially, which caused the interior distress we observed. As for the exterior damage to the stoops, driveways, sidewalks, roads and garages, this was caused by inadequately compacted backfill that has subsequently settled, causing the distress in these areas.

(Ex. G-44 at 110)

263. The design of the garage footings was inadequate because--

> The houses were designed to have the garage footings at a higher elevation than the basement footings. This would not necessarily have been a problem, except that ARC chose to achieve that elevation difference through the placement of backfill under the garage footings.... The backfill provides a different support condition than the natural soil that a part of the garage footings rested upon [creating] the potential for settlement of the garage footings. When this is combined with rigidly attaching the garage to the house, which was done in this case, there is a high risk that even relatively small amounts of settlement of the soil beneath the footings will cause some structural distress in the units.

(Ex. G-44 at 32)

264. He also criticized ARC's failure to redesign the PFD when it switched from trench footings to spread footings. To be effective, the PFD has to be placed at the

interface between the backfill and the subgrade where water collects. The M2 design correctly located the PFD on top of the trench footings. The change in the method of constructing the footings raised the PFD above the correct location, making the drain ineffective. Compounding the problem, ARC overexcavated and placed anywhere from 6 to 27 inches of gravel and/or sand beneath the footings, raising the PFD even higher above the correct location. Although ARC alleges that it lowered the PFD in the M3 contract, the PFD in one of the two test pits excavated by URS was still on top of the footing. (Ex. G-44 at 37-42, 55)

265. Mr. Kovski found fault with the design of the basement slab because it did not provide for a proper slip joint or a sufficiently large slip joint (ex. G-44 at 43). TD&H recommended in its report for the M2 contract that "interior, non-bearing partition walls resting on floor slabs...be provided with slip joints" and Mr. Zahller reiterated that recommendation in his comments on ARC's 50% drawings during the design phase (53723, R4, tab 1A, report at 14; app. supp. R4, tab 21 at 25; tr. 7/97). Maxim's August 1998 report, which governed the earthwork for the M3 contract, recommended slip joints of "at least 2 inches" (R4, tab 147 at 11; 54038, R4, tab 28, spec. § 02200, ¶ 3.01A). We find lacking in credibility, and disregard, Mr. Dethloff's testimony that the government agreed to a ¾-inch as opposed to a 2-inch slip joint (tr. 7/98). In any event, ARC is responsible for this aspect of the design.

266. Mr. Kovski described the slip joints he saw as follows:

> [T]he contractor tried to create something like a slip joint but didn't quite make it work. There was a gap of about ¾" at the top of some of the non-bearing basement partition walls on the unfinished side of the wall, but on the finished side, the sheetrock spanned from floor to ceiling with no gaps or slip joints. As the slab heaved, load was transmitted upward [causing] cracking and bowing.... [I]n a few...homes[,] I saw blocks of wood in the gap [at] the top of the basement partition wall [which would] be a source for immediately transmitting the load to the first floor. [T]his load transmission...is one of the causes of the distress....

(Ex. G-44 at 44)

267. On 4 January 2000, ARC's QC manager, noted a similar criticism:

> Why do we put a slip joint at BSMT [basement] walls (¾" gap) yet we solid tape corners eliminating the true slip. M-2

> now has many sheetrock cracks and breaks because we don't have a true slip joint.

(R4, tab 836-84)

268. Mr. Kovski also criticized the design of the basement slab because the stairway was connected directly to the basement floor slab. Both TD&H and Maxim recommended that the basement floor slabs "float", *e.g.*, that they be structurally isolated from all bearing walls and columns to allow unrestrained vertical movement (53723, R4, tab 1A, TD&H Report at 14, tab 3C at 14; 54038, R4, tab 147 at 11). Mr. Zahller reiterated this recommendation during the design process (app. supp. R4, tab 21 at 24). The minutes of the 50% design meeting on 24 February 1998 state: "The basement wall and floor slab details were discussed and ARC will build the basements with floating concrete slab" (*id.*, tab 23 at 2, ¶ 10). However, ARC's final design required that the stairways be connected directly to the slabs. As a result, when the slabs moved as they were bound to do, the stairways moved, causing significant damage to the interiors. (Ex. G-44 at 43) ARC's poor workmanship compounded the problem. At least one stairway had only three nails attaching it to the wall studs. The government's construction representative testified that there should have been three 2 x 4-inch stringers with four nails per stringer (R4, tab 835-01, report 30; tr. 1/215, 2/87).

269. In Mr. Kovski's opinion, ARC's preparation of the foundation was improper because it left debris and clods on the subgrade (ex. G-44 at 61-62; tr. 6/130). Many of the clods were two feet in diameter. When left in the backfill, large clods cause gaps and voids. When the gaps and voids collapse, they lead to settlement, providing a pathway for water to reach the fat clay below. ARC also left debris in the backfill, such as rebar, wooden fence posts, 2 x 8 pieces of lumber, and steel stakes. These materials make it difficult to achieve compaction. In addition, they provide a pathway for water to infiltrate the fat clay below and cause heave. (G-44 at 78-79; tr. 6/131)

270. ARC did not comply with the specification requirements for dewatering. The specifications required that the excavations be dewatered, that standing water not be allowed to collect in the excavations, and that moisture-softened soil be removed prior to pouring concrete. (Ex. G-44 at 62-66) Mr. Kovski calculated that about 24 percent of the units had accumulated drainage water during construction of the M2 contract and that 19 percent of the units had accumulated drainage water during construction of the M3 contract (*id.*).

271. Although the specifications for the M2 contract required that saturated fat clays found in the building footing or utility trench areas be excavated and backfilled with compacted stabilized material, they did not define compacted stabilized material (53723, R4, tab 1A, spec. § 02200, ¶ 3.05F). Mr. Kovski interpreted it to mean material

with some strength for bearing capacity and a relatively low permeability, such as a silty clay (ex. G-44 at 51). ARC used 6 to 27 inches of road base gravel, sand, or a layer of each, under the footings in the M2 contract (ex. G-1, ¶ 5.4.6.1 (revised 12/08/04), ex. G-44 at 55). Mr. Kovksi indicated that neither road base gravel nor sand was a compacted stabilized material:

> Q. Does the gravel and sand used by ARC meet this requirement for a compacted stabilized material?
>
> A. No.... The gravel ARC used is highly permeable, meaning that water can infiltrate and flow through it easily. Sand is very similar in that it is a highly permeable material. In this case, you don't want to place a permeable material on top of expansive clay, particularly when you have a way for water to migrate into the highly permeable gravel or sand, and no way of intercepting and removing that water. This provides the highly expansive fat clay with a ready source of moisture, which...is the source of much of the damage in the units.
>
> ....
>
> Q. [W]hat is the effect of using...gravel...under the footings?
>
> A. [U]se of gravel allowed the collection of free flowing water on the subgrade soils and [caused] them to heave much, much sooner than if the moisture was not allowed access to the fat clay subgrade. As Mr. Juel testified on p. 437 of his deposition, "now you've got heave occurring much sooner after construction and occurring to a greater magnitude because you're facilitating...moisture migration." Even Mr. Haley [ARC's expert], admits in his deposition on p. 476, that he would not have recommended gravel be placed under the foundation, because it provides more opportunity for water to have access to the expansive soils.

(Ex. G-44 at 51-52)

272. If gravel had been intended as a compacted stabilized material, Mr. Kovski stated that the specifications would have included a compaction standard for gravel. The only compaction standard called out by the specifications was ASTM D 698, which

requires the use of Proctor curves. Proctor curves are not used for gravel. Thus, Maxim had to create an entirely new compaction standard for gravel. (Ex. G-44 at 52)

273. In order to facilitate drainage of the gravel under the footings, Mr. Klevberg recommended that ARC drill 500 3/8-inch holes around the bottom of the sump basins. URS looked at the sump basins in about half of the buildings. Some "had a couple of holes in them, but most of them did not have holes in them" (tr. 6/117). Mr. Klevberg also recommended that the sumps be lowered to increase drainage. As designed, the top of the basin was at about the same level as the basement slab. Taking into account the 4-inch basement slab, 6-inch cushion course, 12-inch thick footing, and 12 to 27 inches of gravel beneath the footings, Mr. Kovski estimated that about three to six inches of sump function at the bottom was lost. In addition, his inspection did not reflect that the sumps had been lowered. (Ex. G-44 at 55-60)

274. The earthwork specification for the M3 contract omitted the term compacted stabilized material, requiring that moisture-affected material be replaced with "compacted material, gravel, or lean concrete" (54038, R4, tab 28, spec. § 02200, ¶ 3.01A.4). Although ARC alleges that it did not routinely overexcavate and place gravel under the footings in the M3 contract, both of the test pits excavated by URS in the M3 contract had gravel under the footings (ex. G-44 at 65-68 (revised 12/8/04)).

275. Data from the deep piezometers indicated "that groundwater is discontinuous and limited to [one particular area] in the M3 contract." URS interpreted the readings from the shallow piezometers to mean that groundwater occurred in isolated, discontinuous pockets of sand within the clay. URS did not find a groundwater aquifer and neither URS nor Maxim discovered an underground lake/river/stream. (Ex. A-1 at 54-55, ex. G-44 at 109-10)

276. The earthwork specification required that the backfill for foundation walls be nonexpansive with liquid limits (LL) of 27 to 49 (53723, R4, tab 1A, spec. § 02200, ¶ 2.01B, 54038, R4, tab 28, spec. § 02200, ¶ 3.01A, R4, tab 147 at 8). Of the 69 samples tested by URS, 47 samples or 68 percent had LL of 50 or more (ex. G-1 at 54, figure 5-9, tables 4-5, 4-6).

277. Mr. Kovski testified that improper compaction caused the settlement of the structures on the foundation backfill, including stoops, porches, gas lines, dumpster pads, sidewalks, and privacy fences. He also indicated that the backfill itself settled, resulting in negative drainage. As a result, surface water was directed towards most of the units and directly into the foundation. He attributed the settlement to three workmanship problems: (1) soil clods and debris in the backfill; (2) lifts that were too thick; and (3) failure to adequately test backfilled areas. (Ex. G-44 at 79)

278. URS performed consolidation tests to determine the amount of settlement that would have occurred if the backfill had been compacted in accordance with the specification (ex. G-1 at 64, table 4-6). These tests revealed the following:

> [I]f compacted in accordance with the...specifications, the backfill soil would have settled at most between 2 ¼ and 3 ¼ inches with a 500 psf [pounds per square foot] load such as the weight of 4 to 5 feet of soil. [W]e noted settlement of the backfill well in excess of 6 inches around many units, including areas where there was no flatwork resting on the backfill. This suggests that since the amount of settlement that has actually occurred is substantially greater than the test results demonstrate should have occurred, the soil was poorly compacted to begin with and is settling significantly more than it would have if it had been properly compacted in the first place.

(Ex. G-44 at 80)

279. Mr. Kovski explained that backfill must be placed in lifts thin enough to ensure uniform compaction throughout the depth of the lift. If the lift is too thick, compaction may be proper in the upper portion, but the lower portion will receive little or no compaction. The thicker the lift, the greater the amount of soils that are potentially undercompacted and the more likely there will be significant settlement in the future. (Ex. G-44 at 83)

280. Mr. Kovski stated that proper testing is critical to insuring compaction:

> Testing...is the quantitative method used to confirm that proper compaction was obtained [and the] primary way to confirm [that the] specifications are being met. However, a technician needs to observe the entire compaction process. By this, I mean [he] has seen that the material was placed in a uniformly and appropriately sized lift, the lift was uniformly and properly moisture-conditioned, and it was uniformly compacted throughout the surface of the lift. Then a test can be taken to confirm whether proper compaction has been achieved. [A] lack of testing or testing in the wrong location is one indication of poor...quality control. And where there is poor control, it's been my...experience that you get a poor result. In this case, you get significant settlement issues.

(Ex. G-44 at 86)

281. The earthwork specification for the M2 contract required that backfill adjacent to the foundation walls be compacted to 92 percent of the maximum dry density in accordance with ASTM D 698. Compacted backfill gets more dense, rather than less dense, over time. None of the samples tested by URS were compacted to 92 percent of ASTM D 698, even four years after construction. (Ex. G-44 at 99, ex. G-1, table 5-2) The Standard Penetration Test (SPT) reflected low blow counts, which is consistent with inadequate compaction. Proctor testing indicated that the backfill materials were consistently compacted dry of optimum by as much as 12 percentage points, which also adversely affects compaction:

> The shear strength behavior of compacted soils in an unsaturated condition (moisture content dry of optimum) is significantly influenced by properties such as the initial water content, stress state and soil structure. Clay materials used in the backfill for all units were compacted at various water contents, generally dry of optimum, and to various densities. This produces "different" soils from a soil mechanics behavioral standpoint.... The engineering behavior will thus vary from one location to another due to differences in soil structure related to the initial water content. As water flows through the voids in the poorly compacted backfill and between the backfill and the basement wall, the backfill materials soften, compress, and move causing settlement under the self-weight of the backfill and the weight of the stoops and garages.

(Ex. G-1 at 62-63, figures 5-14, 5-15, 5-16)

282. Mr. Kovski interpreted the QC plans to require, at a minimum, two tests for each eight-inch lift. He testified that three tests for each eight-inch lift was the norm within the industry. If the area was less than 2,000 square feet, at least 2 tests per 8-inch lift were required. If the area was more than 2,000 square feet, more than 2 tests per 8-inch lift were required. (Ex. G-44 at 87-90)

283. Based on his interpretation, Mr. Kovski calculated that ARC was required to perform a minimum of 1,464 tests in the backfill around the 69 buildings in the M2 contract or a minimum of 21 tests in the backfill for each building (ex. G-44 at 90-91; tr. 12/90). He calculated that a minimum of 860 tests in the backfill around the 36 buildings in the M3 contract were required, or a minimum of 24 tests per building (ex. G-44 at 96; tr. 12/90).

284. Using Maxim's compaction test reports, Mr. Kovski determined that there were 105 passing tests in the backfill in the M2 contract or less than 2 passing tests per building (ex. G-1, table 5-1, ex. G-44 at 92). For the M3 contract, he counted 58 passing tests in the backfill or less than 2 passing tests per building (ex. G-44 at 96-97). Of the 22 buildings URS selected for its study, 11 did not have any passing tests in the backfill (ex. G-1, table 5-1, ex. G-44 at 92). Most of the tests were performed at the very bottom of the excavation or at the finished grade at the top, with very few tests performed in the middle. Based on the lack of testing of the middle lifts, the settlement he observed at the site, and the results of URS' forensic testing, Mr. Kovski concluded that the middle lifts were not properly placed and compacted (ex. G-44 at 92-93).

285. Mr. Kovski testified that a structural floor system would move under certain circumstances:

> Even [structural floor systems] move. And even that system, had you impounded water in the basement, would be migrating down and causing those piers to heave.... So, its not a "fix all end all" solution.
>
> What you want to do is, is you want to exclude water, control water and design the structural connections in such a way that they can tolerate the movement.
>
> All buildings move. Whenever there's a load on any structure, there's movement. The question is, is it excessive for the purpose that's intended.
>
> And in this case, what we needed was movement that was less than the amount that's causing all these finish problems, as well as the clearly inappropriate amount of movement of the first floor.

(Tr. 6/149-50)

286. If the houses had been constructed in accordance with the design, Mr. Kovski was of the opinion that the risk would have been spread out over 10 to 15 years:

> Every foundation design carries with it some level of risk, with or without basements. With the design we have here, there was a risk of movement, but had the houses been constructed in accordance with the design,...we wouldn't expect to see noticeable distress for many years after

> construction [and certainly not] so quickly after construction if ever.... I think it would be 10 to 15 years before you would perceptibly notice the heave of the basement slabs.

(Ex. A-44 at 19-20)

287. In December 2002 and January 2003, URS inspected 96 units (ex. G-1, table 1). URS observed a significant increase in the amount of damage to the units, including all 22 buildings included in its initial study (ex. G-1 at 70). URS estimated that it would cost a little over $19 million to repair the 96 units (ex. G-1, table 1; G-44 at 109).

XVII. ARC's Geotechnical Engineering Expert - Mr. Steven C. Haley

288. ARC called Mr. Haley as a "non-neutral" expert in geotechnical engineering (tr. 11/61). He obtained a Bachelor of Science in engineering in 1964 and a Master of Science in engineering in 1966. Both degrees were awarded by the University of California, Los Angeles. Mr. Haley is a registered professional engineer in the states of Arizona, Hawaii, and Nevada, and a registered geotechnical engineer in the state of California. He worked for Woodward-Clyde/URS Corporation from 1966 to 1998, retiring as a senior vice-president. In 1998, he founded Steven C. Haley Consulting, Inc., of which he is president. The company provides neutral and non-neutral expert witness services in civil and geotechnical engineering. Since 1999, more than half of his work has focused on earthwork, water, and drainage problems. (App. supp. R4, tab 1550)

289. Mr. Haley made three site visits over six days (tr. 11/58). He observed the inside of 15 buildings in phases I and II and 10 buildings in phase III. He observed the outsides of about three dozen units, including the 22 buildings selected by URS, and was allowed to inspect the inside of one of the URS units. Mr. Haley performed manometer surveys, which test the levelness of the floors, in seven units in the M2 contract. (Ex. A-9 at 23-24, ex. A-13, appendix A; tr. 11/192-96)

290. Mr. Haley testified as follows: (1) MMV was a government-designed project; (2) SOG construction with full basements was a "fatal flaw;" (3) the changes made by Amendment No. A0004 cheapened the design; (4) the government failed to disclose the extent of the water at the site; (5) ARC handled the water in a reasonable manner and in accordance with the drawings and specifications; (6) footing drains were unnecessary; and (7) gravel under the footings did not adversely affect the project. Although he did "not contend that ARC placed all of the backfill material to the project specifications," Mr. Haley nonetheless concluded that the government's substantial reduction of the compaction standards, poor drainage design, and elimination of stoop foundations were "major contributors and the root causes of most of the exterior settlement problems." (Ex. A-9 at 9; tr. 11/14)

291. Despite the fact that the RFP for the M3 contract allowed crawl spaces or basements, Mr. Haley testified that ARC did not have any real choice but to propose SOG construction with full basements, pointing out that there were only 33 days between the RFP and the bid due date and that the design had to be compatible with the units being built under the M2 contract (ex. A-9 at 18-19).

292. In Mr. Haley's opinion, SOG construction with basements was not suitable for the following reasons:

> [T]his site has sands over highly expansive clays [which] have a strong electrochemical affinity for water....
>
> [I]n nature, this is in balance with evapotran[s]piration. [T]he clays...bring in water, and...the sun and wind tak[e] [it out].
>
> [O]nce you cover them up with any kind of slab,...this [process] is disrupted and the clays...start to increase in moisture and heave.
>
> ....
>
> [T]he basic...problem was putting the [SOG] and shallow foundations on these highly expansive soils. When an owner does that, they have to accept the risks like we have seen of the expansive soils problems at the site.

(Tr. 11/14-15)

293. Mr. Haley alleged that the government "misled ARC and other potential contractors relative to the prevalence of groundwater" at the site. (ex. A-9 at 34). Citing the Environmental Assessment (EA), he indicated that the site did not have any natural drainage and contained non-draining depressions. As a result, water "goes down into the sand and then sits on the clay" (tr. 11/40). The EA also stated that a retention pond or some other means of draining the site would have to be created if the project went forward. Although there were three small wetlands areas or depressions at the proposed site, the EA indicated that the area on which they were located was deleted from the project prior to award. (App. supp. R4, tab 572-49)

294. Mr. Haley also asserted that the government failed to disclose that NTL found water in two out of three piezometers in April 1997. The NTL data was not

directly disclosed to bidders. However, base personnel felt so strongly that perched water might be found in some or many of the silty, sand lenses at the site that they added the following language to paragraph 3.05F. of the earthwork specification via Amendment No. A0004:

> Perched water in sandy, silty soils may be encountered at lower elevations on the site. Where saturated fat clays are found in the building footing or utility trench areas, excavate saturated material and backfill with compacted stabilized material or lean mix concrete as directed by the Soils Engineer and Contracting Officer.

(App. supp. R4, tabs 615, 616)

295. Mr. Haley pointed out in his report that government personnel proposed the use of "compacted stabilized material (screened pit run)" as replacement fill in the footings in connection with Amendment No. A0004 (ex. G-9, Juel dep., ex. 12, ex. A-9 at 42). TD&H rejected the proposal, stating that "pit-run gravel or other free-draining material should not be used as replacement fill..." (ex. G-48, tab 2). Mr. Haley also argued that the earthwork specification allowed the use of gravel under the footings (ex. A-9 at 42). However, paragraph 2.02 defined rocks over three inches as unsuitable for fill construction and for subgrade under structures, piping, or paving. Paragraph 3.05F required that saturated fat clay found in the building footing or utility trench areas be excavated and replaced with compacted stabilized material or a lean mix concrete. Neither of these paragraphs allow the use of gravel under the footings. Moreover, ARC did not prove that gravel was a compacted stabilized material. Mr. Haley also alleged that gravel did not cause the heave in phases I and II because ARC did not use gravel in phase III and there was more heave in phase III than in phases I and II. Although Mr. Dethloff testified that ARC did not use gravel in phase III, his testimony has been unreliable on other issues and we find that it is unreliable on this issue, particularly since both of the test pits excavated by URS in phase III had gravel under the footings. In addition, it appears that the additional heave could just as easily have been caused by ARC's failure to provide positive drainage, which resulted in the partial termination of the grading and landscaping portion of the phase III contract. In our opinion, Mr. Haley did not adequately address this issue.

296. Mr. Haley seemed somewhat reluctant to render an opinion on the propriety of gravel under the footings at the hearing (tr. 11/36, 44, 190-91, 264-65). During his deposition, however, he testified that he would not have recommended that gravel be placed under the footings because it provides more opportunity for water to access the expansive soils (ex. G-44 at 52).

297. At the hearing, Mr. Haley was shown a 2-½ minute DVD prepared by Mr. Nelson of J&K Excavating, ARC's earthwork subcontractor (app. supp. R4, tab 1448; tr. 11/54-56). Mr. Haley testified that the DVD depicts "perched water" flowing into the bottom of a sewer line trench at manhole 40. However, Mr. Jones, who was present at the site, testified that the problem at manhole 40 was not perched water:

> [T]he J & K guys [were] struggling with getting water out of the trench because right next to the trench was a pond of water about four...inches deep and about 100 feet in diameter.
>
> They would pump the trench back into the pond, and the next morning the pond had drained back into the trench.
>
> And finally after about three or four days, [I said] why don't you just drain that crap across the road. And they pumped it across the road, and a few days later, they were able to get back in there and work.

(Finding 60)

298. Mr. Haley also asserted that there was an "underground lake/stream feeding the highly expansive clay around each building" (ex. A-1 at 41). The record does not confirm this contention. Mr. Kovski considered this possibility in his study and concluded as follows:

> From a common sense perspective, it just doesn't make any sense that a stream flows underground so selectively that it only causes the most lightly loaded aspects of the houses to sink....
>
> ....
>
> [URS] reviewed...the Cascade County Soil Survey [and] found no record of any shallow aquifers that would affect the houses. We reviewed the TD&H and Maxim reports and found no evidence of subsurface sources of water other than perched water that might be encountered seasonally in sand lenses.... In addition, we installed site-wide piezometers, to monitor for groundwater sources.... We...found some perched water, but no evidence of any "underground streams" or shallow aquifers....

(Ex. G-44 at 109-10)

299. Initially, Mr. Haley took the position that the testing specification ("one test each 2000 square feet of each 8" lift") was more suitable for large fill spreads than wall backfill. Thus, he interpreted the specification to be volume-based. In his opinion, there was no requirement to test each building and the specification could be interpreted to require one test per 50 cubic yards of backfill ((2,000 sq. ft.) (8"/12") (1/27 cubic ft/cubic yd)) or as deemed appropriate by the soils engineer. (Ex. A-13 at 29) When shown the QC plans for the contracts, which required testing of "each layer and subgrade, min. 2 tests," he changed his opinion:

> Q. What meaning do you give to ["each layer and subgrade, min. 2 tests"]?
>
> A. I interpret that, combined with the specifications and my experience, [to require] two tests per building.
>
> ....
>
> Q. Does this say, Mr. Haley, "each layer and subgrade minimum two tests"?
>
> A. [It] says "minimum two tests".
>
> Q. And you interpret that to mean each building?
>
> A. Yes.
>
> Q. If the appropriate interpretation of this, Mr. Haley, were that each lift was to receive two tests, would that change your opinion regarding whether or not ARC did adequate compaction testing in the backfill?
>
> ....
>
> A. Well, they would not have met a two-test-per-lift specification....

(Tr. 11/297-99)

300. A paralegal employed by Watt Tieder tabulated the number of field density tests reported in Maxim's compaction test reports for the M2 contract for Mr. Haley, including failed tests and retests (table 1 of Mr. Haley's report) (tr. 11/83, 302; ex. A-13). The paralegal did not testify. Other than to double-check the failures identified by the

paralegal, Mr. Haley did not review the reports (tr. 11/303). In his pre-filed testimony, Mr. Haley asserted that Maxim took 615 tests in the basement wall backfill (ex. A-9 at 49-50). He computed this number by adding in tests taken at the stoops (137 tests), porch footings (53 tests), and trash/walkways (169 tests), which were subject to different compaction requirements (ex. A-13 at 6). Our review of table 1[5] of Mr. Haley's report indicates that Maxim took 183 field density tests in the basement wall backfill for the M2 contract, and that there were 3 failures and 3 retests (ex. A-13, table 1).

301. In Mr. Haley's view, the changes made by Amendment No. A0004, including allowing the use of fat clay as fill material, "had a major impact on reducing the quality of the project" (ex. A-13 at 5). According to Mr. Haley, paragraph 2.01B of the earthwork specification, which was not modified by Amendment No. A0004, allowed the use of fat clay in the foundation backfill. Paragraph 2.01B stated, in part, that "[b]ackfill for foundation walls shall be nonexpansive soils with liquid limits of 27 to 49" (53723, R4, tab 1A, spec. § 02200; app. supp. R4, tab 6, § 02200). Although Mr. Haley indicated in his pre-filed testimony that a liquid limit (LL) of 50 or more was fat clay, he testified at the hearing that soils with a LL of 40 to 60 were fat clay (ex. A-9 at 11; tr. 11/46). When confronted with the fact that paragraph 2.01B required backfill for foundation walls to be nonexpansive, he responded that "[t]hey can call it anything they want, but it is an expansive material" (*id.*). In its report, URS classified material with LL of 50 or more as fat clay (ex. G-1, table 5-9 (revised 10/8/04)). Of the 69 samples from the foundation wall backfill that URS tested, 31 had LL of 60 or higher (ex. G-1, tables 4-5, 5-9 (revised 10/8/04)).

302. Mr. Haley also criticized the government's selection of ASTM D 698 as the compaction standard, pointing out that TD&H cited the more stringent ASTM D 1557 in its report for the M2 contract (tr. 11/47-48). The original RFP for the contract as amended by Amendment No. A0002 required that earth backfill for structures be compacted to 95 percent of the maximum dry density of ASTM D 698. Amendment No. A0004 lowered the requirement to 92 percent for earth backfill around the basement walls. Since ARC failed to compact the backfill around the foundation walls to 92 percent of ASTM D 698, we fail to see how changing the standard to ASTM D 1557 would result in more passing tests. Mr. Zahller testified that he did not have any problem with changing the standard to ASTM D 698 for a residential facility of this type, and Mr. Kovski testified that the change would not have a significant bearing on the work (tr. 5/243, 6/15-16, 275-77).

---

[5] Table 2 of Mr. Haley's report purports to tabulate the number of tests taken during phase III. We do not deem the information in table 2 to be useful because it does not distinguish between field density tests and relative density tests and does not list the number of failed tests and retests (ex. A-13).

303. Mr. Haley also testified that the elimination of straw-filled augured holes (augured holes), which were deleted by amendment A0004, "increased the potential for basement heave" (ex. A-9 at 16). He conceded that augured holes were "not a commonly used technique," that he had never recommended their use, and that he had not performed any calculations to assess their value (tr. 11/108-11). Other than Mr. Haley's unsupported assertion, there is no evidence that this technique has been used successfully on other projects. In Mr. Zahller's opinion, augured holes would be "more detrimental" than useful and he recommended against using them (tr. 5/243-44). Mr. Juel testified that they would not help prevent heave and would create more surface area for water to access the underlying fat clay (tr. 6/70-74).

304. Amendment No. A0004 deleted the interior footing drain, but left the requirement for the exterior footing drain intact. Mr. Haley testified that "[y]ou really don't need a foundation drain, and it doesn't make sense to have a foundation drain" (tr. 11/37). He suggested that a PFD could be detrimental if it became clogged, but noted that the URS report found that the drains at the site were passing water freely (ex. A-13 at 20-21).

305. Mr. Haley also criticized the fact that Amendment No. A0004 deleted the footings for the stoops and rear porches, allowing them to "float. In Mr. Haley's view, the change made the stoops and rear porches subject to frost heave and backfill settlement. He considered "this cost savings design change to be particularly significant in that it resulted in the large sinking stoops problem at the site" (ex. A-9 at 16). Mr. Haley did not perform any calculations to substantiate his opinion. Mr. Kovski testified that settlement occurs only when the downward pressure exerted by the overburden exceeds the level of compaction of the underlying materials and that the stoops and rear porches would not have settled if the backfill had been properly compacted (tr. 6/135-38). After performing some calculations, he testified as follows:

> Q. So if the material had been properly compacted to 92% of ASTM D698, how much would you have expected it to settle?
>
> A. None.
>
> Q. And did you perform these same calculations for the garage footings?
>
> A. I did. I anticipated that the argument would be made that 92% was also the standard under the garage...and I did the same analysis.

....

> And I estimated settlement...of about three-tenths of a foot in the worst case...maybe half inch.
>
> Q. …And when you say "worst case" [what do you mean?]
>
> A. I'm making the most favorable [assumption] for Mr. Haley's contention that it would settle, and I don't see how you get more than a half inch.

(Tr. 6/138-39)

306. Mr. Haley also asserted that the vapor barrier deleted by Amendment No. A0004 would have slowed down the rate at which post-construction free water reached the footing drains and the highly expansive clay under the floor slabs. He also asserted that the vapor barriers would have made the downward movement of moisture more uniform. (Ex. A-13 at 19-20) At the hearing, he conceded that there were varying opinions concerning the effectiveness of vapor barriers, that "properly compacted backfill with a proper slope" could function as a vapor barrier and that a vapor barrier placed over improperly compacted backfill could direct water into the foundation (tr. 11/112-16). Messrs. Zahller, Klevberg, and Kovski all testified that the usefulness of vapor barriers was marginal (tr. 5/108-10, 6/15, 274-75). Mr. Carlin, Soltek's operations manager, agreed (tr. 5/55-56).

307. Mr. Haley criticized the change from waterproofing to dampproofing, alleging that it allowed "water penetration of basement walls and negatively affected [the] project" (ex. A-9 at 17). In support of this view, Mr. Haley indicated that there had been some leaks in the area of the egress window wells (ex. A-9 at 27; tr. 11/118).

XVIII. ARC's Structural Engineering Expert - Mr. Michael W. Lee

308. Mr. Lee earned a Bachelor of Science in structural engineering in 1981 and a Master of Science in structural engineering in 1983. Both degrees were from the University of Texas at Austin. He is a registered professional engineer in the states of Texas, Arkansas and Oklahoma. Since graduation, he has worked in private industry. He is presently a senior structural engineer at Wiss, Janney, Elstner Associates, Inc., in Dallas, Texas. Approximately one-third of his projects either directly or indirectly involved distress associated with heave from expansive soils. Over his 25-year career, he

estimated that he has designed or investigated at least 500,000 square feet of floor slab located in areas with expansive soil.

309. Mr. Lee was asked to provide an expert opinion regarding the structural engineering design. He performed a one-day site visit and inspected six units. Mr. Lee concluded that there was no structural damage. (Ex. A-7 at 6-7, 9). With respect to SOG construction, he opined as follows:

> The distress [was] caused by the [government's] improper selection of a basement floor slab supported directly on soil. The selection was improper because there was ample information indicating that construction using ground-supported slabs would be prone to problems due to heaving of the expansive soils. Had [it] selected a structural floor system, the heave would not have affected the basement floor slab and the distress would not have occurred.

(Ex. A-7 at 5)

## DECISION

These design/build contracts involved the phased construction of 194 units of military family housing at MAFB. The contracts required that the units be built using SOG construction with full basements. Both parties knew that the site was predominantly fat clay and that fat clay would heave if exposed to moisture. Shortly after the work was completed, the slabs heaved and the structures on the foundation backfill settled, causing widespread damage to the units. The government argues that ARC's design choices and shoddy construction practices caused the damage. It argues that it properly revoked acceptance and terminated the contracts due to (1) latent defects; (2) gross mistakes amounting to fraud; (3) failure to deliver the as-built drawings; and (4) failure to accomplish the warranty repairs. ARC argues that the revocations and terminations were improper because (1) the root cause of the distress was the government's specification of SOG construction in an area underlain by fat clay; (2) Amendment No. A0004 deleted features that would have reduced the distress; (3) the government had actual knowledge of ARC's noncompliant construction methods; and (4) the CO failed to exercise discretion in terminating the contracts.

### Gross Mistakes Amounting to Fraud

Under the Inspection of Construction clause in the contract, acceptance is final and conclusive except for latent defects, fraud, gross mistakes amounting to fraud, or the government's rights under any warranty or guarantee. In our view, the critical issues are

whether the finality afforded by the Inspection of Construction clause has been vitiated on the basis of gross mistakes amounting to fraud, and whether the government revoked acceptance within a reasonable period of time.

The elements required to prove "gross mistakes amounting to fraud" are the same as for fraud, except that there is no requirement to prove intent to deceive (or mislead) the government. *Chilstead Building Co.*, ASBCA No. 49548, 00-2 BCA ¶ 31,097 at 153,575; *Bar Ray Products, Inc. v. United States*, 340 F.2d 343, 351 n.14 (Ct. Cl. 1964). In order to prove fraud, the government must show that (1) acceptance was induced by its reliance on (2) a misrepresentation of fact, actual or implied, or the concealment of a material fact, (3) made with knowledge of its falsity or in reckless or wanton disregard of the facts, (4) with intent to mislead the government into relying on the misrepresentation, and (5) that the government has suffered injury as a result. *Bender GmbH*, ASBCA No. 52266, 04-1 BCA ¶ 32,474 at 160,615, *aff'd*, 126 Fed. Appx. 948 (Fed. Cir. 2005); *Chilstead*, 00-2 BCA ¶ 31,097 at 153,575; *Dale Ingram, Inc.*, ASBCA No. 12152, 74-1 BCA ¶ 10,436 at 49,331.

The government's right to revoke acceptance under the Inspection of Construction clause is not barred by government inspection failures. *E.g*., *Chilstead*, 00-2 BCA ¶ 31,097 at 153,575-76 (roofing contractor's representation that it was proceeding in accordance with the drawings followed shortly thereafter by installation of deviant trusses was a gross mistake amounting to fraud despite the government inspector's failure to measure or inspect); *Z.A.N. Co.*, ASBCA No. 25488, 86-1 BCA ¶ 18,612 at 93,489 (delivery of improperly marked watches was a gross mistake amounting to fraud despite the fact that government representatives may not have acted "with a maximum of circumspection"); *Massman Construction Co*., ENG BCA No. 3443, 81-2 BCA ¶ 15,212 at 75,343 (contractor's failure to use prequalified weld joints (among other things) was a gross mistake amounting to fraud despite the fact that the government's inspection was "inexcusably bad"); *Jo-Bar Mfg. Corp.*, ASBCA No. 17774, 73-2 BCA ¶ 10,311 at 48,684-85 (contractor's determination that aircraft bolts did not have to be heat treated and failure to treat them, coupled with misrepresentation to the government inspector that it had been advised heat treatment was not required was a gross mistake amounting to fraud despite possible lack of in-process inspection by government).

However, acceptance must be revoked within a reasonable time after the mistake is discovered or could have been discovered with ordinary diligence. *Bar Ray Products, Inc. v. United States*, 162 Ct. Cl. 836, 838 (1963). No precise formula exists to determine the reasonableness of the delay. The determination must be made on a case-by-case basis. However, the government's efforts to determine conclusively that the work was defective or to work with the contractor to solve the problem will be taken into consideration in determining the reasonableness of the delay. *Perkin-Elmer Corp. v. United States*, 47 Fed. Cl. 672, 674-75 (2000) (latent defects). Thus, revocation of

acceptance more than six years after learning of the defect was unreasonable. *Perkin-Elmer*, 47 Fed. Cl. at 674-75. A seven-month delay between discovery of the defects and revocation of acceptance for the A/E to investigate the cause of the defect was reasonable. *Chilstead*, 00-2 BCA ¶ 31,097 at 153,575. A one-year delay between the CO's request for tests and revocation of acceptance where tests took less than two weeks was not "remotely prompt action." *Ordnance Parts & Engineering Co.*, ASBCA No. 40293, 90-3 BCA ¶ 23,141 at 116,186. A 10-month delay to test wall paneling to determine if it had been "incombustible treated" was reasonable. *Jung Ah Industrial Co.*, ASBCA No. 22632, 79-1 BCA ¶ 13,643 at 66,929, *aff'd on recon.*, 79-2 BCA ¶ 13,916) (latent defects).

In *Catalytic Engineering and Manufacturing Corp.*, ASBCA No. 15257, 72-1 BCA ¶ 9342 at 43,365-66, *aff'd on recon.*, 72-2 BCA ¶ 9518, we defined gross mistakes amounting to fraud as follows:

> The Board concludes that reasonably intelligent contractors reading the sentence in the context of the inspection article would understand the words "such gross mistakes as amount to fraud" to mean that there must first be a major or great or serious mistake made and that this mistake must have occasioned the acceptance of the [work]. However, unlike "fraud" which has the connotation of deliberate misstatement or improper action with an intent to deceive, "mistake" has a diametrically opposed connotation. "Mistake" connotes an unintentional misstatement or action which produces an unintended and undesirable result. "Gross mistake" connotes a mistake so serious or uncalled for as not to be reasonably expected, or justifiable, in the case of a responsible contractor....
>
> ...The Board [also] concludes that reasonably intelligent contractors would understand that in order for gross mistakes to amount to fraud there must be a false representation or misrepresentation of a material fact (as opposed to a matter of law or matter of opinion) but that such a false representation or misrepresentation could be by words or conduct or by false or misleading allegations or by the concealment of, i.e., failure to disclose, facts that should have been disclosed in the circumstances.

<u>The M2 Contract</u>

The contract contained 100 percent specifications and 35 percent drawings prepared by the government's A/E and required ARC to perform the work in accordance with those documents. In addition to requiring SOG construction with full basements, the specifications contained detailed requirements for the performance and testing of the earthwork. No deviations were permitted. (Finding 19)

Among other things, the specifications prohibited the use of topsoil, debris, frozen material, rocks over three-inches, and other unsuitable material as fill material (finding 25). ARC frequently placed two to three foot clods against the foundation walls and beneath the front door stoops (*see* findings 37 to 44). ARC's failure to remove clods created large gaps and voids in the backfill. The collapse of these gaps and voids led to settlement. ARC also placed icy material two feet in diameter against the basement walls (findings 43, 44). This material also created gaps and voids that caused settlement. ARC also left substantial amounts of debris in the backfill, such as a wooden fence post, steel stakes, and 2 x 8 pieces of lumber in the backfill, making it difficult to achieve the specified level of compaction (finding 48). Most importantly, clods and debris in the backfill provided a pathway for water to reach the highly expansive soils in the subgrade, causing heave (finding 269).

The specifications required fill to be placed in lifts not exceeding eight-inches (finding 25). ARC routinely placed fill in lifts of three feet around the foundation walls and in the utility trenches and two feet in the garage areas (finding 74). In one area, ARC placed fill in lifts of six or eight feet (finding 76). Mr. Jay Nelson of J&K, ARC's earthwork subcontractor, testified that ARC just "pushed [in] whatever was closest to the building" (finding 35). ARC's equipment could not adequately compact lifts of more than 16 inches and Maxim's nuclear densometer could not test below 12 inches (finding 79). Thus, the middle portions of the lifts were undercompacted.

The specifications required that the backfill around the foundation walls be compacted to 92 percent of ASTM D 698 (finding 25). Compacted backfill gets more dense rather than less dense over time. None of the samples tested by URS were compacted to 92 percent even four years after construction. (Finding 281) Consolidation tests performed by URS indicated that if the soil had been properly compacted, there would have been, at most, 2 ¼ to 3 ¼ inches of settlement. URS observed settlement of well over six inches. (Finding 278) The standard penetration test reflected low blow counts, indicative of inadequate compaction. Proctor testing showed that the backfill was compacted dry of optimum by as much as 12 percentage points, which increased the likelihood of settlement. (Finding 281) Due to the lack of compaction, all of the structures resting on the foundation backfill experienced significant settlement, including the stoops, porches, gas lines, dumpster pads, sidewalks, and privacy fences. In addition, the backfill settled, causing negative drainage toward most of the units. (Finding 277)

The specifications required that the excavations be dewatered and prohibited standing water in the excavations. Soils softened by water were to be removed before earth fill or concrete was placed. (Finding 25) On 25 August 1998, ARC's QC manager reported that "J&K [ARC's earthwork subcontractor] is immediately backfilling areas of water encountered and compacting as to go unnoticed. I have asked [them] repeatedly to cease this procedure [to] no avail" (finding 63). This practice allowed moisture to enter the fat clay underlying the site, causing heave. Since fat clay is highly impermeable, moisture moves downwards very slowly, causing each successive layer to heave. Heave will continue until equilibrium is reached, which is the point at which the upward pressure exerted by the swelling clay equals the downward pressure exerted by the overburden. Given the depth of fat clay at this site, equilibrium might not be reached for years. (Finding 3) Mr. Kovski estimated that 24 percent of the units in phases I and II had accumulated drainage water (finding 270).

ARC overexcavated the footings and placed 6 to 27 inches of free draining gravel below 70 to 75 percent of the footings in the M2 contract (findings 54, 264, 271). Prior to pouring concrete, the quality control specification required ARC's soils engineer, Mr. Klevberg, to observe the bottom of each excavation (finding 25). To avoid having to wait for Mr. Klevberg to come to the site and inspect the excavations, ARC asked if it could overexcavate, place granular fill (gravel) in the bottom of the excavation, and pour concrete. Mr. Klevberg agreed. (Findings 50, 51) The specifications did not include a compaction standard for gravel, so Maxim created one (finding 272). The specifications allowed ARC to use compacted stabilized material to replace saturated fat clay in the footing and utility trench areas (finding 25). However, ARC failed to prove that gravel was a compacted stabilized material. Mr. Kovski pointed out that even Mr. Haley, ARC's geotechnical engineering expert, testified in his deposition that placing gravel under the footings was not proper because it provided more opportunity for water to have access to the expansive soils (finding 271, *see also* finding 296).

The specifications required that the backfill around the foundation walls be nonexpansive with LL of 27 to 49 percent (finding 25). URS defined material with LL of 50 as fat clay. Mr. Haley defined material with LL of 40 or 50 as fat clay. Of the 69 samples tested by URS, 47 samples or 68 percent had LL of 50 or more. (Findings 276, 301)

The QC plan, which became part of the contract upon approval by the CO, required that the following tests be performed:

> ONE TEST EACH 2000 SQUARE FEET OF EACH 8 INCH LIFT, AND AS REQUIRED TO VERIFY PROPER BACKFILLING OF STRUCTURES AND CONFINED

AREAS. EACH LAYER AND SUBGRADE, MIN. 2 TESTS

(Finding 22, *see also* finding 24, spec. § 01450, ¶ 1.08F.4)

Mr. Kovski interpreted this provision to require a minimum of two tests per eight-inch lift. If the area was more than 2,000 square feet, additional tests were required. If the area was less than 2,000 square feet, at least two tests for every eight-inch lift were required. (Finding 282) Initially, Mr. Haley took the position that there was no requirement to test every building. When he was shown the approved QC plan, however, he changed his opinion and testified that ARC was required to test every building and, in his opinion, ARC would not have met a two-test per lift requirement. (Finding 299) We accept Mr. Kovski's interpretation of the testing plan.

Based on his interpretation, Mr. Kovski calculated that the M2 contract required 1,464 tests in the backfill around 69 buildings or 21 tests per building. His review of Maxim's compaction test reports revealed that ARC had only 105 passing tests in the backfill or less than 2 passing tests per building. The tests were generally concentrated at the very bottom of the excavation or at the top of the finished grade with very few tests in the middle. Mr. Kovski testified that this raised serious questions in his mind about the adequacy of the compaction in the middle of the lifts. (Findings 283, 284)

Without Maxim's compaction test reports, the government could not evaluate ARC's compliance with the compaction requirements or make a reasoned decision regarding the acceptability of the work. Maxim's compaction test reports were the only source for the results of the field testing performed by Maxim. Among many other things, Maxim's compaction test reports recorded the number of the Proctor curve used, the maximum density of the Proctor curve used, the measured dry field density, and the percentage of compaction. To determine the percentage of compaction, the technician divided the dry field density by the maximum density of the applicable Proctor curve. For example, a field density of 87 divided by the maximum density of Proctor curve 2610 (93) yields 93.5 percent compaction, which meets the requirement for backfill around the basement walls (92 percent), but does not meet the requirement for backfill in the trenches (98 percent). (Findings 128, 131)

ARC concealed Maxim's compaction test reports from the government. The specifications required ARC to "promptly" submit copies of each day's inspections and tests, including Maxim's compaction test reports, to the CO (finding 24). Work began on the M2 contract in April 1998 (finding 30). On or about 3 August 1998, ARC directed Mr. Klevberg to stop sending Maxim's "products or deliverables or reports or letters" to the government (finding 133). Ms. Long, who was ARC's office assistant from 14 September 1998 until 17 October 2000, was the custodian of the reports. Ms. Long

stated in her affidavit that she was the sole person receiving and placing the reports into binders, that the binders were kept in an ARC conference room, that the conference room was not accessible to non-ARC employees, that she never distributed the reports to anyone, and that, to her knowledge they were not distributed to the government or anyone else. (Finding 134) The final increment of the M2 contract was accepted on 29 October 1999 (finding 139). Despite repeated requests, ARC did not provide the reports to the government until 24 October 2000, just as the warranty period for the last increment of units was expiring (finding 135).

After receiving the reports, the government asked TD&H to review them and prepare a report. TD&H issued its report on 6 February 2001. TD&H found that ARC had 158 tests (excluding 2 retests) in the foundation backfill, or 2.2 tests per building and that 19 buildings or 26.7 percent did not have any tests at all in the foundation backfill. (Finding 162) This is just a fraction of the 1,464 tests required by the contract (finding 283). Of the 160 tests performed in the foundation backfill (including 2 retests), 83 tests or 51.9 percent were at subgrade or within 1 foot of finished grade. Excluding 209 tests that did not identify the test depth or were taken at footing grade for garages and porch footings, 1,055 tests or 85.6 percent of nonfooting tests were taken at subgrade or within 1 foot of final grade. TD&H concluded that the settlement was "the direct result of insufficient compaction of the foundation backfill soils adjacent to the basement foundation walls" (finding 162).

Mr. Haley's Opinion

Mr. Haley, ARC's geotechnical engineering expert, offered the following opinions: (1) since the government designed the project, it impliedly warranted the adequacy of the specifications; (2) SOG construction with full basements was a "fatal flaw" for this site; (3) the changes made by Amendment No. A0004 cheapened the design; (4) the government misled bidders as to the extent of the water at the site; (5) ARC handled the water in a reasonable manner and in accordance with the drawings and specifications; (6) footing drains were unnecessary; and (7) gravel under the footings did not adversely affect the project (finding 290).

Design specifications explicitly state how the contract is to be performed and permit no deviations. Performance specifications specify the results to be obtained and leave it to the contractor to determine how to achieve those results. *Stuyvesant Dredging Co. v. United States*, 834 F.2d 1576, 1582 (Fed. Cir. 1987). Although the M2 contract was issued as a design/build contract and left some design work to ARC, including the structural drawings (including the structural calculations), the mechanical drawings, and the plumbing drawings, the drawings and specifications required that the units be built using SOG construction with full basements (finding 19). Thus, the government impliedly warranted that, if followed, SOG construction would be suitable for this site.

*United States v. Spearin*, 248 U.S. 132, 136 (1918); *Essex Electro Engineers, Inc. v. Danzig*, 224 F.3d 1283, 1289 (Fed. Cir. 2000); *Blake Construction Co.*, 987 F.2d 743, 746 (Fed. Cir. 1993).

We have carefully considered the opinions of Mr. Haley and do not find them persuasive. He opined that the specification of SOG construction with full basements was defective because placing the slabs interrupted the process of evapotranspiration. He also opined that there was an underground lake/river/stream flowing through the site that fed the expansive clay around the buildings. (Findings 292, 298) However, he did not present any objective evidence for either theory. He generally avoided answering questions about the propriety of placing gravel under the footings. However, he testified at his deposition that he would not have recommended placing gravel under the foundation because it provides more opportunity for water to access the expansive subgrade soils (finding 296). Beyond Mr. Haley's unsupported testimony, there is no evidence that the changes made by Amendment No. A0004 adversely affected the M2 contract. In addition, the record seriously contradicts his contention that ARC handled the water at the site in a reasonable manner and in accordance with the plans and specifications (*see, e.g.*, findings 57 through 65). His testimony about foundation drains was unpersuasive (finding 304). Mr. Haley erred (or perhaps was not informed) about the contents of the approved QC plans. He first testified that there was no requirement to test every building. However, when shown the QC plan, he testified that ARC was required to test every building and that it would not have met the requirement for two tests per lift. (Finding 299)

We are convinced that but for ARC's defective workmanship the slabs would not have heaved for 10 to 15 years (*see* finding 7). Unlike Mr. Haley, Mr. Kovski performed a thorough study of the causes of the distress. He concluded that inadequate foundation preparation, including mismanagement of water, improper selection of the foundation backfill, and improper compaction allowed moisture to reach the expansive subgrade and caused it to heave. Since ARC's drawings placed structural elements on the slabs, contrary to TD&H's and Maxim's recommendation (finding 4), the upward pressure was transferred from the slabs to the walls, stairway, and ultimately to all levels of the structure. Once the load was transferred, the elements of the structure moved differentially, causing distress to the interiors. Based on Maxim's compaction test reports, he also concluded that the damage to the exteriors, including the stoops, driveways, sidewalks, road, and garages, was caused by settlement resulting from inadequate compaction. (Finding 262)

Mr. Lee's Opinion

Mr. Lee, ARC's structural engineering expert, inspected six units and concluded that there was no structural damage. He also opined that SOG construction was not

suitable for this site. He did not discuss any of ARC's workmanship defects or attempt to explain why the slabs heaved so quickly after construction. In his opinion, the problem is simple: heave would not have affected the slabs if the government had selected a structural floor system; therefore, SOG construction was defective. (Finding 309) This does not resolve the matter. As a matter of law, the government is entitled to strict compliance with its specifications. The government is not required to select the best design, the design that will last the longest, or even a design that will be maintenance-free. The government's design need only be reasonably suitable for its intended purpose. *Mumford & Miller Concrete, Inc.*, ASBCA Nos. 53652, 53653, 07-2 BCA ¶ 33,586, *aff'd*, 260 Fed. Appx. 977 (Fed. Cir. 2008); *Defense Systems Co.*, ASBCA No. 50918, 00-2 BCA ¶ 30,991 at 152,989.

On this record, we can only conclude that ARC's concealment of Maxim's compaction test reports and its own egregious workmanship defects, critical to knowledge of the quality of the work, were gross mistakes amounting to fraud, justifying revocation of acceptance of the M2 contract. The government relied at time of acceptance on ARC's representation that the units were complete and ready for occupancy (findings 137-39). We have considered all the other arguments advanced by ARC in this regard and find them to be without merit.

Reasonableness of Time Taken to Revoke Acceptance and Terminate the M2 Contract for Default

We deem 6 February 2001, the date on which TD&H issued its report on Maxim's compaction test reports, to be the appropriate start date for measuring the reasonableness of the time taken to revoke acceptance and terminate the contract. On 7 February 2001, ARC advised the CO that it had prepped four stoops and that it would begin repairs the following week. On 16 February 2001, ARC submitted a repair schedule for eight stoops. The schedule indicated that the repair plans for the four-bedroom units and the rear stoops were not yet complete, but that ARC would submit those plans for approval prior to beginning work. (Finding 164) On 21 February 2001, ARC advised the CO that it was ready to start repairing the front stoops (finding 165).

In March 2001, ARC began repairing the front stoops using the "temporary" solution it had submitted on 13 July 2000. On 6 April 2001, the CO directed ARC to advise her by 9 April 2001 as to whether the "temporary" solution for repairing the front stoops would be the "permanent" solution. If the solution was only temporary, the CO directed ARC to submit its permanent solution by 9 April 2001. In the same letter, the CO directed ARC to submit a permanent stamped fix for the back stoops and grading by 9 April 2001. On 9 April 2001, ARC indicated that it was attempting to obtain a stamped plan for the front stoops, that the repair plan for the four-bedroom front stoops was still

under consideration, and that it hoped to submit its plan by the end of April 2001. (Finding 167)

ARC submitted a stamped copy of its fix for the rear stoops on 30 April 2001 and asked that the deadline for the rest of its plan be extended to 30 May 2001 (finding 168). On 14 May 2001, the CO provided comments to ARC on its proposed stoop repair plan and requested that ARC resubmit the plan by 22 May 2001 (finding 169). On 17 May 2001, government representatives, including Ms. Rounsavill, met to discuss the contracts. They agreed to take a two-pronged approach: to try to get ARC to perform the repairs and, as a back-up, to seek funding for a repair plan to be prepared by the government. They also agreed that work would cease on 1 July 2001. (Finding 170) On 31 May 2001, the CO approved Stroebel Architects & Consultants as ARC's new A/E (finding 172).

On 11 June 2001, the CO issued a "Warranty of Construction" letter to ARC (finding 173). Among other things, the letter noted that ARC had failed to resubmit its stoop repair plan as requested by the CO on 14 May 2001. The letter also stated that ARC had not provided a (1) a comprehensive plan; (2) concept scenarios; (3) suitable construction drawings and specifications for soil subsidence around the units by a registered A&E firm; and (4) a milestone schedule with a detailed work performance to fix the drainage problem this construction season. The letter also provided a copy of the results of the April 2001 walk-through. The CO concluded by directing ARC to reply by 20 June 2001 with its corrective actions.

On 10 July 2001, the CO suspended all work on the M2 contract indefinitely (finding 175). On 11 July 2001, Mr. Dethloff replied that there had been a severe water saturation problem at the site over the past 18 months for which the government was responsible. On 26 July 2001, government representatives met with ARC to discuss the M2 and M3 contracts and another ARC contract which had apparently been terminated. (Findings 176, 177) On 31 October 2001, the CO issued a show cause notice (finding 179). The CO terminated the contract for default on 19 December 2001 (finding 180). Under all the facts and circumstances present here, we find that the 10 ½ months the CO took to revoke acceptance and terminate the contract was reasonable.

Abuse of Discretion

ARC argues that the termination of the M2 contract must be set aside because the CO's customer gave her "marching orders" to terminate the contract and she failed to comply with FAR 49.402-3(f). In making this determination, we look to see (1) whether there was subjective bad faith on the part of the CO; (2) whether there was a reasonable basis for the final decision; (3) the degree of discretion granted to the CO; and (4) whether there has been a violation of the applicable laws and regulations. *Shubhada*

*Industries, Inc.*, ASBCA No. 54016, 08-1 BCA ¶ 33,733 at 167,019; *Quality Environment Systems, Inc.*, ASBCA No. 22178, 87-3 BCA ¶ 20,060 at 101,569, *citing Darwin Construction Co. v. United States*, 811 F.2d 593, 598 (Fed. Cir. 1987). ARC bears the burden of proof on this issue. *Sayco, Ltd.*, ASBCA No. 36105, 91-1 BCA ¶ 23,568 at 118,165.

We have carefully reviewed the record and do not discern any evidence of bad faith on the part of the government. In our opinion, Ms. Rounsavill demonstrated remarkable patience in dealing with ARC. We also find that she articulated a reasonable basis for the termination in the show cause notice and the final decision. Although she was told in June 2001 that the "marching orders" from her customers were to terminate the contract and throw ARC off the base, preferably by July 2001, she did not terminate the contract until 19 December 2001, some five months later. We find that she exercised her discretion in terminating the contract. Contrary to ARC's arguments, FAR 49.402-3(f), which sets forth the so-called "FAR factors," does not confer any rights on the defaulting contractor. *DCX, Inc v. Perry*, 79 F.3d 132, 135 (Fed. Cir. 1996), *cert. denied*, 510 U.S. 992 (1996). Moreover, it appears that she implicitly considered most these items in conjunction with the show cause and the final decision.

The M3 Contract

The facts relating to the revocation of acceptance and termination of the M3 contract are undisputed. The government accepted the last increment of units under the contract on 21 November 2000 (except for the grading and landscaping). The CO suspended work on the M3 contract indefinitely on 10 July 2001, the same day on which she suspended the M2 contract. (Findings 244, 245) The parties met on 26 July 2001, but were unable to resolve their differences (finding 177). On 2 October 2001, the CO partially terminated the landscaping and grading portions of the contract. The appeal was docketed as ASBCA No. 54039 and later dismissed as untimely. The CO revoked acceptance and completely terminated the M3 contract for default on 17 September 2002 on grounds substantially similar to the M2 contract, 22 months after acceptance of the last increment of units in the M3 contract. (Findings 246, 248) On these facts, we conclude that revocation of acceptance was not proper because it was not done within a reasonable time. Thus, the government's acceptance of the M3 contract other than grading and landscaping is final. Since final acceptance precludes the exercise of either a default termination or a convenience termination, we set aside the termination for default and deny ARC's request for a convenience termination. *Hogan Construction, Inc*., ASBCA No. 39014, 95-1 BCA ¶ 27,398 at 136,595; *Gavco Corp*., ASBCA No. 29763 *et al.*, 88-3 BCA ¶ 21,095 at 106,502.

CONCLUSION

The appeal of ASBCA No. 53723 relating to the M2 contract is denied for the reasons stated above.

The appeal of ASBCA No. 54038 relating to the M3 contract is sustained except to the extent that ARC seeks conversion of the termination for default to a termination for convenience.

Dated: 30 June 2009

ELIZABETH A. TUNKS
Administrative Judge
Armed Services Board
of Contract Appeals

I concur

MARK N. STEMPLER
Administrative Judge
Acting Chairman
Armed Services Board
of Contract Appeals

I concur

EUNICE W. THOMAS
Administrative Judge
Vice Chairman
Armed Services Board
of Contract Appeals

I certify that the foregoing is a true copy of the Opinion and Decision of the Armed Services Board of Contract Appeals in ASBCA Nos. 53723, 54038, Appeals of American Renovation and Construction Company, rendered in conformance with the Board's Charter.

Dated:

CATHERINE A. STANTON
Recorder, Armed Services
Board of Contract Appeals