PART 1. DEVELOPMENTAL HISTORY

The Roots of Mission 66

The decade following World War II witnessed a period of sustained prosperity perhaps unmatched in American history. Enormous productive capacity, billions of dollars in wartime savings, a large, educated work force, high levels of government spending, and relatively little competition in world markets combined to make the United States the dominant global economic power. The middle-class benefits of home ownership, automobile travel, higher education, discretionary spending, and increased leisure time were available to millions more Americans than ever before. The country recovered from a decade and a half of depression and war through a wave of consumer spending on homes, cars, televisions, and recreational activities, including travel.

Automobile travel had been a growing force in American society since the early 1920s, although it had slowed during the depression and the war years. In the postwar period, however, auto tourism reached unprecedented levels particularly in the West. As one historian described the postwar tourist boom, "More than ever, the West served as America's playground."1 As automobile ownership increased, tourist traffic in the West and throughout the nation skyrocketed. "In 1945.5 to 7 million tourists had visited the
West; in 1950, 20 million; and in 1960, 50 million.2 Tourism had long been a factor in the West's economy, but the region had never witnessed anything like the wave visitors it experienced in the years after World War. II. Other parts of the country felt the impact of the car culture as well. Throughout America, more and more visitors descended on the nation's national parks as their vacation destination.

The economic adage "The rising tide lifts all boats" proved true for more Americans than ever before during the postwar boom as the nation's growing economy lifted millions of Americans to new heights of prosperity. The adage held true, however, only so long as one's boat had not sprung a major leak. And by the mid-1950s, America's National Park system was a very leaky vessel indeed. While the infrastructure of many national parks had been improved substantially during the New Deal of the 1930s, the system as a whole had been largely untouched since the

outbreak of the Second World War. At the same time, visitation to the parks increased dramatically. Between 1931 and 1948, visitation increased almost tenfold, from 3,500,000 to almost 30,000,000. Basic maintenance lagged behind, not to mention the need for vastly improved and increased visitor facilities and enhanced protection methods to guard against adverse impacts on resources resulting from visitation. The postwar Director of the National Park Service, Newton B. Drury, described the parks as "victims of the war." Despite his repeated warnings about the plight of the parks, however, Drury was unable to secure additional appropriations to address the deterioration condition of the parks. Drury's successor, Conrad L. Wirth, also pressed for increased funding for the National Park Service, but during his first years in service, funding remained inadequate to address the acute conditions relating to resource protection and the provision of appropriate visitor services.

The condition of the parks became a minor public scandal in the late 1940s and early 1950s. The journalist and social critic Bernard DeVoto triggered a debate on the future of the national parks. In his Harper's magazine column, "The Easy Chair," DeVoto proposed closing the national parks to the public until the federal government took responsibility for managing and maintaining them properly. DeVoto's column prompted park supporters, including John D. Rockefeller, Jr. to express their concern to the Eisenhower Administration. President Eisenhower characteristically took no action other than to request a briefing on the status of the parks from Secretary of the Interior Douglas McKay. The administration and the general public gradually became aware of the need for massive renovation of the National Park Service and the parks it oversaw.

The growing realization that the national parks had reached a state of emergency coincided, or perhaps prompted ad reorganization of that portion of the Interior Department under the jurisdiction of Undersecretary Ralph Tudor. The bureaucratic reorganization allowed Conrad Wirth to focus on the escalating crisis within his bureau. Wirth began to articulate an ambitious agenda to correct the long-standing inadequacies within the national parks. Rather than try to secure yearly funding increases in the annual federal budget, Wirth sought to secure a multi-year funding program. Guaranteed funding would enable Wirth to pursue a fundamental overhaul of the national park system. As part of this 10-year program the park service would repair, rebuild, or construct new park infrastructure such as roads, bridges, and trails. The increased budget

would allow the bureau to hire new employees, construct new facilities ranging from campsites to administration and maintenance buildings, improve employee housing, and obtain land for future parks. Perhaps most importantly, it would provide for the construction of a new kind of public facility, the national park visitor center. The end result of Wirth's ambitious 10-year plan would be a modernized, revitalized national park system to be unveiled in time for the 50th anniversary of the National Park Service in 1966.

The Mission 66 Visitor Center

The concept of a visitor center actually preceded the actual implementation of the Mission 66 program. Park service planners in the postwar era visualized a new type of facility that would balance resource protection with visitor use by managing visitor circulation in a new and efficient manner. Just as the name implies, visitor centers would serve as the centralized visitor service facility to manage the rapidly increasing numbers of tourists at National Park Service sites. The centers were intended to provide a "one-stop shopping approach for park visitors, "the center of the entire information and public service program for a park."[1] Within a visitor center, park visitors could expect to find NPS administrative staff, museum exhibits, and modern interpretive programs. Director Wirth explained to the NPS that the term "visitor center" applied to any NPS facility that served as a major concentration point for visitors.[2]

The development of the visitor center concept was a modernizing element of the park service in the early 1950s. Postwar National Park Service facility design that predated the Mission 66 program incorporated modern designs and technical solutions like the high-speed passenger elevators at the Carlsbad Caverns visitor center in order to enhance visitor access to the park resources. The modern approach to managing visitation ultimately led to the introduction of a significantly new and different architectural style in the national parks. Previous park service architecture had been dominated by a rustic design style that featured rough-hewn materials of stone, timber, or adobe intended to harmonize the built environment with the surrounding

[1] William Nelson Noll, "Mission 66, the National Park Service Program for the Revitalization of America's National Parks, 1955-1966," (Master of Arts Thesis, Kansas State University, 1997), 11-12. Cited in Allaback, *Mission 66 Visitor Centers*, 17.
[2] Ibid, 17-18.

landscape. This created what historian Sarah Allaback has termed "pseudo-vernacular imagery"[3] to describe the perception that rustic architecture created and its role in helping to define the visitor's park experience. The shift to a more "modern" park service tailored to meet the needs of the increasingly affluent and mobile park visitors of the postwar era quickly led in turn to the creation of a new architectural vernacular to guide and shape the National Park Service visitor experience.

"Park Service Modern"

The evolution of modern architecture had begun in the middle of the nineteenth century in Europe, but modern architectural principles were essentially a European export and therefore did not begin to influence American design until the 1920s. The philosophies of the International style and the Bauhaus school represented for many a design revolution that incorporated physical elements of the 19th Century industrial revolutions in Western Europe and the United States. Just as large-scale industrialization favored efficiency and economies of scale over traditional skilled craftsmanship, so did modern architectural design adopt a more strictly rational approach in the choice of industrial materials such as concrete, glass, aluminum, and exposed structural steel. Architects of the Bauhaus school consciously adapted the design aesthetics of industrial production in their designs. As the modernist movement gained increasing strength in the 1920s and 1930s, influential European architects sought refuge in the United States in the years before the outbreak of World War II. Their arrival coincided with a greater acceptance of modernist concepts among American designers. The sheer scale and ambitious schedules of government planning, design, and construction undertakings during the Roosevelt administration's New Deal allowed for greater innovation in design of a wide range of governmental facilities. The development demands of the government during the war dwarfed those of the New Deal. Combined, the public construction during the New Deal and the war gave tremendous impetus to the modernist movement in American architecture.

The timing proved fortuitous for the National Park Service. Although the idea likely would have been anathema to the Eisenhower administration, the multi-year Mission 66 program resembled

[3] Allaback, *Mission 66 Visitor Centers*, 23.

to a small degree the large government programs of the New Deal era. The NPS intended essentially to remake itself over a ten-year period, not just its physical infrastructure but also in the way it served visitors and interpreted the resources under its jurisdiction. This would require the coordination of substantial road and facilities projects with visitor access and interpretive programs while simultaneously continuing to provide adequate protection for those resources. Continuing to develop the costly and labor intensive rural vernacular architecture of the early park service was not a viable option for Mission 66. The efficiencies supposedly inherent in modern architectural design became very attractive to the heads of a government bureau that was preparing to reinvent itself within a decade. Although more traditional thinkers within and outside the park service were horrified by the prospect of modern architecture in the parks, many park service architects such as Cecil Doty of the NPS Western Office for Design and Construction were inspired by the opportunity to introduce a new architectural expression to the National Park environment.

Like the rustic style that preceded it, "Park Service Modern" design was intended to harmonize with the surrounding landscape, but in a significantly different way. Through the use of native materials and by virtue of their relatively small scale, rustic-style buildings blended into the park landscape. Larger Mission 66 visitor centers, designed to accommodate far greater numbers of park visitors, were intended to be unobtrusive, not by virtue of their size, but by the nature of their architectural style. Unornamented, utilitarian, Mission 66 buildings would enable visitors to look past or through the structure to the resource beyond. The degree to which park planners embraced this philosophy is illustrated by the fact that visitor facilities encroached more and more on the resources the parks had been established to protect.

This was the practical application of the other overarching goal of Mission 66, to arouse public interest and awareness of the parks through more effective, thought-provoking interpretive programs. "According to Robert Utley, chief historian of the National Park Service beginning in 1964, historians such as Roy Appleman and Ronald Lee favored siting visitor centers `right on top of the resource' so that visitors could `could see virtually everything from the visitor center.'"[4] The fact that visitors were often quite literally in or on the resources they had come to

[4] Allaback, 27.

see was regarded as a reasonable impact by an agency determined to educate and enlighten those visitors. While this "you are there" design strategy was frequently applied at battlefields and other cultural sites, it was perhaps no more fully realized than at Dinosaur National Monument. At Dinosaur, the National Park Service took Mission 66 one step further: instead of putting the visitor center in the resource, the NPS put the resource in the visitor center.

The Quarry Visitor Center

President Woodrow Wilson proclaimed Dinosaur National Monument in 1915 to preserve what was then the richest late-Jurassic paleontological site in the world. In the decades after its discovery in 1909, the quarry at Dinosaur shipped nearly 700,000 pounds of fossil bones to Pittsburgh's Carnegie Museum alone.[5] In 1924, paleontologist Earl Douglass who discovered the quarry, envisioned the construction of a shelter that would protect both the site and future visitors to the quarry.

> The uncovered area should be housed to protect the specimens and provide shelter for sight-seers and students. The north side would be a natural wall, of course, with the skeletons in place. The south side would probably be a natural wall also but the ends would have to be built and a roof with ample sky lights would cover the whole. The extra space and the walls could be utilized for many other exhibits from this most interesting geological and paleontological region.[6]

Throughout the first decades of the 20th Century, Douglass and others within the academic community and the National Park Service continued to press for the development of a shelter at the quarry. The Depression halted any possibility of funding such an ambitious project. The proposal regained momentum during the New Deal and the park service in 1937 submitted a preliminary design that resulted from the collaboration of the American Museum of Natural History and the NPS Western Office of Design and Construction (WODC). Surprisingly, this design concept resembles the modernist approach of Mission 66 more than it did the rustic style that had dominated park service design to that point. The American entry in World War II ended any hopes of funding for actual construction of any shelter at Dinosaur, but despite the

[5] Ibid., 41.
[6] Richard G. Beidleman, "The Dinosaur Museum – From Idea to Reality," in Administrative History, Dinosaur National Monument, 1963, Denver Service Center, Technical Information Center. This quotation is from Douglass' correspondence cited in the administrative history.

constraints that the war effort placed on the parks, the NPS still produced two design alternatives for a museum at Dinosaur in April, 1944. These initiatives stalled in the immediate postwar period and the park service settled in the early 1950s for a temporary structure to protect the site and allow for visitor access. Mission 66 provided the vehicle for realizing Earl Douglass' dream for the quarry, but only after Dinosaur became the center of one of the pivotal environmental battles of the 20th Century.

If the losing battle over Yosemite's Hetch-Hetchy Valley dam helped create the nation's modern environmental movement, the environmentalists' victory in the fight over the upper Colorado River Basin Project at Echo Park in Dinosaur proved that the movement had come of age as a social and political force. The construction of an enormous dam and reservoir at the confluence of the Green and Yampa Rivers for irrigation and hydroelectric power appeared inevitable in the years after the war. The public conservation movement for preservation of the canyons at Dinosaur that began in 1950 had within a few years generated nearly irresistible momentum. The Sierra Club and other environmental advocates swayed popular and political opinion in favor of saving the canyons of Dinosaur. By 1955, Interior Secretary Douglas McKay removed Dinosaur's Echo Park from the Upper Colorado River project. With Dinosaur's profile elevated in the national consciousness, and motivated also to demonstrate a commitment to Dinosaur's preservation, the National Park Service pushed now for the construction of the quarry shelter. This construction project at a once obscure NPS site would become perhaps the preeminent example of Park Service Modern architecture. It would also create for the NPS a recurring maintenance headache that persists to the present day.

Anshen and Allen, Architects

In the history of Dinosaur National Monument, the year 1955 was significant primarily for the environmental victory over the proposed dam at Echo Park, but it was also important to the park's future in another way. That year witnessed the creation of a modernist design that profoundly influenced the ultimate realization of the long-anticipated shelter for the Dinosaur quarry. The San Francisco architectural firm of Anshen and Allen designed the Chapel of the Holy Cross outside Sedona Arizona. The chapel was the most dramatic manifestation of the

firm's philosophy of adapting physical design to the client's vision and particular needs. "From the beginning, Anshen and Allen espoused no particular style or architectural methodology, but prided themselves on creating the 'variety' that evolved naturally out of clients' desires and programmatic needs."[7] In the case of the Sedona chapel, the client's expressed desires were the creation of a modernist design that complemented the chapel's setting in a natural red rock formation. Anshen and Allen succeeded spectacularly in accommodating the clients' wish for modern architecture that became part of the rugged cliffs overlooking Sedona. Their use of concrete enabled the structure to meld into its setting; its glass wall helped blur the line between the natural and built environments. These materials and the graceful curving ramp that brought worshippers from the parking areas into the chapel emerged as the defining features of the Sedona chapel. These features in all probability helped persuade National Park Service designers that they had found the designers equal to the challenging setting of the Dinosaur quarry.

Anticipating that achieving Mission 66's vast program would prove a daunting task, the professional journal *Architectural Record* recognized that the Sedona chapel could serve as the prototype for the introduction of modernist architecture in national parks, particularly those in desert environments. The journal cited the challenges of scale, scenery, color, and lighting which designers must address in national park settings. The Sedona chapel offered a practical, perhaps even preferred alternative to the rustic model of previous NPS designs. The initial selection of Anshen and Allen, however, appeared less the result of inspiration than of necessity. The clock on Mission 66 was already ticking and the park service was highly motivated to line up contract architects to help implement the program. Within six months of its interview with the Western Office of Design and Construction, the firm was hired to design the Quarry Visitor Center, one of the first high-profile projects intended to signal that Mission 66 was underway. Anshen and Allen's founding principle, to create designs that matched a client's "desires and programmatic needs", would be tested by a client with both complex programmatic needs and design ideas of its own.

Preliminary NPS designs for the quarry building envisioned a windowless shed illuminated by artificial light. Anshen and Allen's designers on the other hand wished from the beginning to

[7] Allaback, 46.

open up the interior through the use of glass walls as at Sedona so that visitors could appreciate the connection between the quarry face and the surrounding environment. The firm's design team worked toward a design that intruded as little as possible between the quarry and the natural setting around it. While they collaborated on the conceptual design with park service architects, the views of the National Park Service Branch of Interpretation, the museum and park staff, and the Director of the National Park Service combined to complicate the development of a final design for the building. Director Wirth in July of 1956 disapproved of the preliminary designs for the visitor center. Museum and exhibit specialists and NPS interpreters initially pushed for a visitor center with interior spaces designed to insulate the visitor from the outside environment. This more controlled interior setting would accommodate evocative interpretive displays and programs. The Anshen and Allen design team felt strongly that adhering to a more traditional NPS approach meant failure to realize the full potential of the Dinosaur site. Pressures within the park service ultimately led the firm to modify their design to the disappointment of the WODC. The Museum branch later changed course dramatically and argued for a building that was open and exposed to natural light. The building that finally emerged from the design process did reflect these features, but not as dramatically as had once been proposed.

In contrast to the building exterior and construction materials which were intended not to intervene between the quarry and the landscape, much of the visitor center's interior design sought to create a colorful contrast to the drab, sun-blasted character of the quarry site. Various colors such as surf green and vernal green, starlight blue and honey beige juxtaposed the building interior from the stark bone white and gray of the quarry site. "The brightly painted surfaces were intended to relieve the monotony of the valley's gray surroundings and, perhaps, create the effect of an oasis in the desert."[8] As park management would learn over the successive decades, insulating the Quarry Visitor Center from the influences of its physical environment would require more far than a few coats of paint.

Early reports indicated frustration with the speed at which the visitor center construction was proceeding. After a month of work following the award of contracts, the park superintendent complained that only fifteen percent of the site had been excavated. Delayed deliveries of

[8] Allaback, 51.

structural steel slowed construction, as did deliberations by Anshen and Allen on the colors for the block and concrete. In fact, by today's standards the building was on an extremely fast track for completion. Less than fourteen months passed from the award of contract on March 19, 1957 to the completion of construction on May 9, 1958. The pressure exerted by the overall Mission 66 timetable and the desire to cultivate a positive public image after the battle over the Echo Park project combined to push the project's ambitious schedule. Unfortunately, none of the safeguards that currently are available to protect the environment from an overzealous federal government were in place during Mission 66. The National Environmental Policy Act was still almost 15 years in the future, so no systematic analysis of the environmental conditions at the site was undertaken, nor were the environmental consequences of the project evaluated. As a result, the understanding on the part of the National Park Service, the architects, and the construction company of the area's geology and the implications for large-scale construction at the site were imperfect at best.

Build in haste, repair at leisure

The Quarry Visitor Center opened to general acclaim in June, 1958. For the National Park Service, the new building was a milestone in the implementation of the grand Mission 66 plan. For Dinosaur National Monument, it was the realization of 30-year dream to construct a shelter for the quarry and the visitors. For the firm of Anshen and Allen, it cemented their reputation in the architectural profession. Combined with the Chapel of the Holy Cross, the Quarry Visitor Center established Anshen and Allen as rising stars on the national design scene. It also provided for all concerned an ongoing education in the dynamic geology of the Morrison formation.

The first hints of problems with the visitor center site emerged even before construction was actually complete. The project's construction foreman noticed cracks radiating in the parking area in November 1957. During the first year of operation, park staff detected a disquieting vibration in the upper gallery. After vibration testing was conducted, the proposed remediation, installing support posts for each beam in the gallery, was rejected by the park. Visitors weren't complaining, however, so the park service chose for the immediate future to look past the problems brewing somewhere beneath the visitor center.

By 1962, the park was again attempting to come to grips with continual upheaval of the visitor center. The Western Office of Design and Construction prepared plans for the reconstruction of the plaza area to address the deficiencies of the drainage system. In March 1966, the park maintenance staff regraded the areas on the north and south sides of the building, realigned the pavement slabs in the east plaza, improved the roof drainage system, and installed additional French drains.[9] Despite the park's efforts, however, all of these patches were little more than band aids on bullet wounds, because the fundamental geological issues afflicting the visitor center remained untouched.

In 1966, the engineering and earth sciences firm Dames and Moore was retained to conduct investigative studies of "adverse movement" of the Quarry Visitor Center.[10] As part of this investigation the firm surveyed and analyzed the soil underlying the site.
In commenting on Dames and Moore's preliminary work, the park reported that the exploratory drilling "proved profitable, as satisfactory foundation materials were encountered at reasonable depths and a water table was found to exist beneath the building and plaza at depths as shallow as 30" below pavement surface…. The Regional Chief of Maintenance will schedule a conference at the SSC, for August, upon receipt of the Dames-&-Moore report, to decide on a course of action regarding rectification of the damage to the building and its environs."[11]

The firm's final conclusions were more disquieting. Dames and Moore had conducted cursory examinations of the site before the visitor center was built. "Dames and Moore conducted a somewhat limited foundation investigation for the Visitor Center Building prior to construction in November of 1956. Four shallow test pits to depths of approximately four feet were dug during this investigation."[12] The firm's subsequent work was far more extensive and more illuminating. Their report concluded that the building's major damage occurred along the lower portion of the foundation for the center support column on the east wall adjacent to the main

[9] Allaback, 59.
[10] Report of Investigative Studies, Adverse Movement, Visitor Center Building, Dinosaur National Monument for the National Park Service. Dames and Moore, Consultants in Applied Earth Sciences, July 14, 1966.
[11] (Report of trip to Dinosaur National Monument, June 1 through June 17. National Park Service, Midwest Region, July 6, 1966.)
[12] Ibid, 2.

entrance. The foundation had moved upward several inches, causing the column to bow inward, which in turn caused separation of the column and the adjacent wall to the north. Several windows in this area were overstressed and had cracked or popped out. "The cobblestone area beneath the spiral walkway adjacent to the east end of the building has undergone severe movement and is offset vertically by as much as five or six inches in some areas."[13] Several of the walkway support piers apparently had moved also.

"We understand that evidence of adverse movement and stress was noted in the east end wall soon after construction. The area immediately adjacent to the spiral walkway was not paved for several years. It has also been reported that a downspout from the roof drainage at the west end was originally allowed to empty adjacent to the foundations. When minor distress appeared, the outlet of the downspout was moved. It does not appear that further damage has occurred in this area."

"On the east end wall where most of the movement has taken place…a tile drain from the roof collector system was recently uncovered and found to be shattered and ineffective. Considerable moisture was found beneath the cobblestone area and adjacent curbs and walkways during recent construction." Some rehabilitation was already proposed for the visitor center. This included re-glazing windows, realigning pavement slabs and patching the roof. Some improvements to the present drainage system were also being made, such as replacing the original French-type drain system. This system "which carries roof runoff and subsurface drainage was to be replaced by a steel pipe which will carry runoff from the roof above ground until it is away from the building area. This pipe also intercepts and collects water from existing French drains at several other locations."[14]

The report's assessment of site conditions stated that "The Quarry Visitor Center is founded upon the Morrison Formation, which consists of alternate layers of shales and sandstones with some limestone….Some of the shales contain bentonitic shales, which are moisture sensitive. Their volume can increase significantly as their moisture content increases. The shale formation

[13] Ibid.
[14] Ibid. 3

underlying the visitor center loses structural integrity when exposed to air or moisture."[15] The firm was careful to point out that even their limited work of ten years before had alerted the park service to the fact that moisture at the site was a serious concern. "In our original investigation, we emphasized that it would be necessary to protect the foundation soils from moisture infiltration. However, due to broken roof drainage lines, snow melt and possible leaking water and sewer lines, moisture protection to the soils adjacent to the foundation on the east end had been ineffective."[16] This resulted in "an upward movement of foundations, floor slabs, and sidewalks." Laboratory tests demonstrated conclusively that the soils "exhibit expansive characteristics when subjected to moisture."

Structural movement was most obvious [at the time of this report] in those elements that had put a relatively light load on the soils, such as sidewalks and floor slabs. "Soils under high confining pressures (such as a structural footing or soils at great depths) will undergo much less expansion than soils under small confining pressures…"

"In addition to the expansion determined by our testing of the residual soils of the site, we believe a major portion of the observed movement has resulted from expansion of the shale."[17] The analysis by Dames and Moore concluded that while their testing clearly demonstrated expansion in the soils, the situation actually may have been more serious than the test revealed. According to their investigation, the shale closer to the surface had "weathered from a dense shale rock to a less dense residual soil during the past nine years….Therefore it would appear that testing of undisturbed samples of the in-place soils at the present time does not really reveal the true degree of expansiveness which has occurred."[18] The firm concluded that no permanent correction for the adverse movement of the visitor center was feasible unless the problems of subsurface moisture were mitigated. "In order to provide protection from moisture, all sources of subsurface moisture must be found and corrected."[19] The possible moisture sources included: roof drainage; rain and snow melt; leakage in water pipes; leakage in sewer pipes; and plant watering and sidewalk washing operations. Unless ways could be found to prevent water from

[15] Ibid. 5
[16] Ibid. 6
[17] Ibid. 7
[18] Ibid.

reaching the areas beneath the building, the soil and the visitor center would continue to move.

Some remedial measures were taken in the wake of the Dames and Moore site evaluation and report. In order to mitigate the heaving of the main support columns at the east and west ends of the building, which had begun not long after construction of the building was completed, the east and west walls and the east main support column were underpinned in 1967. In underpinning these structural elements, crews installed four 12-inch diameter 40-feet deep straight shaft drilled piers adjacent to the east main column pad footing. The crew then transferred the load from the footing to the piers by means of two grade beams spanning pairs of piers. This approach was only partially successful. The west wall remained stable, but the east wall continued to move.

Building movement at Dinosaur was not unique to the visitor center. In March of 1983 DSC personnel made an inspection of the movement and structural displacement of the maintenance building at the park. They reported that "The south wall showed some large differences in readings indicating that movement very likely has occurred. Cracks in the building substantiate that movement has occurred. The trip report concluded that "It is uncertain what has caused the soil under the foundation to allow the building to settle, but the main concern is to stop further settling and deterioration of the building." The recommended treatment was to drive or drill additional piles to support some of the building columns. "The columns could be jacked and straightened to some extent; however, the structural strength of the building will not be impaired if the foundations are stabilized. This should be done as soon as possible because the building appears to be continually moving." The problems with the maintenance facility underscored the troublesome nature of the Morrison formation geology and the difficulties involved in mitigating its impacts on the park's structures.

Throughout the 1970s and 1980s the Quarry Visitor Center continued to move. Structural shifts resulted in significant alterations of interior spaces and diminished capacity for either administrative or visitor functions. Walls moved, floors buckled, windows cracked. A water main break in 1983 further compounded the problems with soil expansion resulting from subsurface moisture. By 1989 the upheaval was sufficient to compromise the structural integrity

[19] Ibid.

of the support system for the visitor gallery deck. The alternative chosen was to install supplemental anchorages to anchor the existing steel roof/visitor gallery deck beams to the masonry pilasters along the south wall.

"In conjunction with this alternative, we are planning to address the condition of the foundation soils under this south wall through another scope of work after proper exploration and evaluation. It is hoped that by removing a surface splash block and asphaltic concrete paving and adjacent to this structure and by installing a drainage system, that the underlying soils will dry and that the wall will move closer to its original position."

According to the regional office, this alternative secured the anchorages of the gallery beams and also "allows us to evaluate the structure after efforts are made to move the structure closer to its original elevation."

The regional office acknowledged that this alternative would prove far more disruptive to the Quarry facility, but felt that the disruption was necessary in order "to follow a sound plan to remedy the poor structural condition of this building, we feel that this disruption is necessary."[20]

At the same time that the National Park Service was preparing to address the problems with the gallery deck, an engineering team from the NPS Rocky Mountain Regional office made a site visit to the park in the spring of 1989 to investigate subsurface drainage conditions at the Quarry Visitor Center, particularly at what the team described as a "distressed pier" of the building entrance ramp. The team's report illustrates both the complexities of the site as well as the inadequacy of applying piecemeal solutions to a systematic problem. "On the morning of May 4… [The crew] began excavating the area around a pier of the entrance ramp at the Quarry visitor's center….Evidently, this areas has had a history of subsidence and the resulting depression has been filled with bituminous concrete. This not only adds to the overburden on the

[20] Memorandum – Associate Regional Director (Acting) Park Operations RMR to Superintendent, Dinosaur National Monument Subject: Selection of recommended alternatives for the repair of the Quarry visitor gallery deck support/south roof. May 23, 1989.

footing, but acts as a barrier to favorable evaporation of moisture from the underlying soil."[21] The site visit identified a number of issues building's instability, including inadequate drainage of the roof and blockage of a French drain on the building's south side. The team also noted that the upper end of the ramp's superstructure was rubbing against the quarry structure at the second story level. The original design had "detailed the end of this bridge as fixed, but it has since broken the connection….a detailed analysis of this structure under various loadings in necessary in order to evaluate its three dimensional aspects. Perhaps a loading condition was overlooked in its original design. Do we need to make allowances for thermal expansion?"[22]

The team's inspection raised more questions than answers but its overall conclusion was clear. Anything less than a comprehensive approach to the problems besetting the visitor center would only postpone a day of reckoning with the fundamental problems of the visitor center site. "The situation that exists at the Quarry Visitors center…is multi-faceted. To say that any one factor is more significant than another would short [sic] our efforts. We need to address the problems literally from the ground up and constantly evaluate our situation as we proceed."

As part of the ground up strategy, the NPS contracted for a comprehensive study of the issues facing the Quarry Visitor Center. The firm Chen Northern Incorporated conducted an exhaustive geotechnical study of the structural distress of the building in 1989. Their findings confirmed and expanded upon the observations that others had made since the building had first exhibited signs of movement over 40 years before and proposed more detailed remedial measures. "It is our opinion that the present distress shown by the building is due to continued uplift from the expansive claystone bedrock. Water leaks from utilities with the building and poor drainage around the perimeter of the building appear to have contributed to moistening of subsoils with subsequent expansion of the claystone. Isolation of utilities from subgrade soils and improvements to exterior drainage of the building may stabilize the structure to some degree. Long term stability, however, may require the use of straight-shaft drilled piers to underpin the

[21] Memorandum. Tim Windle, Civil Engineer, Branch of Roads and Architecture, RMR, to Chief, Division of Construction and Maintenance. Trip Report, DINO, 5/3-5/89, foundation exploration of Quarry Visitor Center.
[22] Ibid., 3.

existing foundation.[23]

Chen Northern's report provided a fairly detailed historical context and chronology for the visitor center's structural failures. "Shortly after it was constructed, the building experienced continuing problems with movements of its foundation…The main support columns at the east and west ends of the building appeared to heave soon after construction of the building causing framing on the east and west windows to skew." Remedial measures were applied, as noted previously. "The east and west walls and the east main support column were underpinned in 1967. Underpinning consisted of installing four 12-inch diameter 40-feet deep straight shaft drilled piers adjacent to the east main column pad footing and then transferring the load from the footing to the piers by means of two grade beams spanning pairs of piers …the west wall appears to have remained stable since the 1967 underpinning but the east wall apparently has moved subsequent to the repair operations."[24]

The ongoing structural movement was again the result of moisture infiltrating the subsurface of the site. "Significant movement of the east wall, two east main columns and adjacent portions of the building occurred in 1983 subsequent to a major water main break under the east end of the exhibit areas of the building. Differential movement between the building and the curved concrete entry ramp at the east end of the building resulted in the ramp detaching itself from its support at the building. Steel supports and wood cribbing have been installed to support the ramp. The south wall of the building has reportedly heaved as much as 10 inches relative to the main columns of the building. The steel beams forming the roof of the southern portion of the building and the second floor cantilevered gallery of the exhibit area of the building have been rotated by the uplift of the south wall of the building. This has resulted in cracking of the pilasters containing the beam anchorages along the south wall."

According to the National Park Service, "the west wall of the building has remained relatively stable since the 1967 underpinning, and that the foundation of the east wall has largely stabilized since the 1983 water main break….Movement of the south wall and circular building element at

[23] Chen Northern, Inc. Geotechnical Engineering Study of Distress to Quarry Visitor Center. December 8, 1989. Cover letter.

the southeast corner appears to be continuing, as evidenced by development of cracks near the tops of the masonry columns of the south wall and cracking in the masonry walls of the circular element. It was thought [that] this continued movement may be related in part to suspected sewer line leaks in this portion of the building. Movement is also thought to be related to suspected backing-up of water in the subsurface trench drain located in the driveway along the south wall."[25]

"After the 1983 water main break in the exhibit area, the water main was isolated in a concrete trench to facilitate detection and repair of subsequent leaks. To our knowledge, no other utilities have been treated in this manner. However, we understand [that] the NPS plans to implement similar measures for water and sewer lines elsewhere in the building."[26]

"Dames and Moore performed a limited foundation investigation consisting of four 4-foot deep test pits for the building in 1956. Subsequently Dames and Moore studied the causes of adverse movement of the structure in 1966. Seven exploratory borings were drilled to depths ranging from 5 to 60 feet and liner and core samples of subsoils and rock were obtained. The conclusion of the study was that the major portion of damage to the building and surrounding walkways had been caused by infiltration of moisture into the underlying expansive soil and rock, resulting in upward movement of the foundation. In the 1966 report, Dames and Moore presented remedial recommendations. The remedial methods recommended consisted of moisture protection and underpinning of existing foundations….Studies of the site by Dames and Moore and NPS personnel indicate a relation between major foundation movements and identifiable subsoil wetting events. These events include the1983 water main break at the east end of the exhibit area and suspected sewer line and drainage backup along the south wall of the building."[27]

On the foundation movement of the visitor center the report concluded, "Since its construction in 1956, the visitor center foundations appear to have undergone up to several inches of upward vertical movement, with significant (p. 10) differential movements, causing varying degrees of

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[24] Ibid., 3.
[25] Ibid., 4.
[26] Ibid., 5.
[27] Ibid.

deformation and distress to the building structure. The present and previous studies have indicated the presence of expansive soils with high swell potential immediately beneath the foundations. It is our opinion that the cause of the observed continuing building movement is continued expansion of the underlying claystone bedrock due to wetting…significant movements appear to have occurred related to significant identifiable wetting events. Swell pressures are generally in excess of the dead load imposed upon the foundation footings, therefore leading to resultant upward vertical movement of the foundation as the subgrade soils and rock become wetted. The previous Dames and Moore study identified a decrease in density of the upper several feet of the claystone bedrock, indicating a reduction in swell potential may have occurred. However, laboratory testing for this study indicates that considerable swell potential remains in the subsoils and rock; even in the very moist materials at shallow depth. We feel it is unlikely that any of the observed movements are due to settlement of foundation soils. Based on our experience with similar soil and rock in the Colorado Front Range area [another region in the Morrison Formation], we also believe it is unlikely that terminating the sources of soil wetting will result in sufficient drying and significant shrinkage to occur causing foundation settlements."[28]

The report offered an exhaustive list of recommendations that essentially sustained the conclusions of the NPS site inspection conducted earlier in the year. "A comprehensive plan to isolate building water and sewer lines should be implemented. We understand that measures are being planned which will consist of placing the water and sewer lines in concrete utility runs which will allow detection of leaks, access for ease of repair in the event of leaks and which will isolated utility lines from the subgrade soils….Drainage around the building should be improved, particularly on the south side. A minimum slope away from the building of 12 inches in the first ten feet in unpaved areas and six inches in the first ten feet in paved areas is recommended. This includes slopes on the north side of the building which presently are inadequate near the building."[29]

Other recommendations in the report include: Backfill previously reported "sinkholes" with

[28] Ibid., 10-11.
[29] Ibid., 13-14.

compacted clay. Erosion protection were drainage from discharges over the steep slope north of the building – downspouts should discharge well beyond the limits of the foundation Consider discharging all roof drainage above ground in well sealed flow pans outletting at least 15 feet from the building perimeter. The existing subsurface drain pipe at the south side of the building should be removed and backfilled with well-compacted clay if above ground-drainage is implemented

Existing gravel trench drain along the sough side of the building should be removed and backfilled with clay. "We believe [that] subsurface drainage is a poor substitute for good surface drainage." (p. 14)

A drainage swale should then be provided along the driveway and at least 15 feet away from the building perimeter to carry water away from the building.

To lessen the likelihood of blockage due to sloughing of the adjacent steep slopes to the south, a low retaining wall or landscaping improvements may be desired. Other drainage features should be should be provided as necessary to maintain the recommended slopes away from the building. Periodic monitoring should be done to evaluate future movements. If movement is shown to be continuing, it may be necessary to implement more direct measures to stabilize the structure.

In order to reduce the potential for future movement, considerations should be given to underpinning portions of the existing foundation which have been experiencing continued movement. The recommended method would be the construction of straight-shaft drilled piers adjacent to the existing foundation and transferring the load on the existing foundation through the footings to the piers, creating a void between the existing piers and the expansive bedrock.

Delta Geotechnical Consultants was retained under contract to conduct subsurface exploration and testing in the maintenance and administration areas including the visitor center The Results of their testing confirmed what previous investigators had concluded. "Soil hydrocompaction appears to be the dominant cause of building distress."[30]

The National Park Service yet again proposed to redress the deficiencies of the visitor center resulting from its troublesome site. "This package proposed to "Rehab/Reconstruct [the] entire

[30] (Order for Supplies or Services from Delta Geotechnical Consultants, Inc. from the National Park Service, Denver Service Center, 09/20/90.)

structure which contains [the] visitor center, sales area, fossil and exhibit viewing area, Paleo lab and preparations area, as well as interpretation offices and library. This structure is architecturally significant in its design and is listed as such. Rehab or construction of this structure would be required to follow these guidelines. Rehabed [sic] or new structure should have a new energy efficient HVAC system. The entire electrical system needs to be upgraded to handle existing loads and potential to expand. Handicap accessibility needs to be considered for the upper gallery.[31]"

"This structure's design and engineering, when originally constructed did not take into account [the potential effect of] the expansive soils it was built on. All utilities, water, sewer, and roof drains were poured in concrete slabs. During the years major water breaks inside [the] structure has caused building to shift and contort. This continued movement through the years has increased water, sewer, and drains to leak, which causes building to continue to move. Original design bearing loads for gallery, roofs, and piers has shifted. Short term cures have been installed to assist in alternate loading and utility problems. Continued shifting of loads and rotation of piers will eventually reach unsafe conditions for visitor and employee areas."

The NPS intended to reconstruct/rehabilitate the entire structure in order to stabilize the building for long term use. This would include a comprehensive plan to isolate building water and sewer from leaking into soil and foundation as well as design a foundation that would allow for long term stability on bentonite and clay soils. Part of this effort would focus on the recreation of "exterior and interior design so as to match historical architecture in detail." This would also include installation of an efficient and adequate heating and cooling system and add much needed storage and office/lab space.

In its supporting statement, the park service stated that "The Quarry Visitor Center has experienced continuous differential movements of the foundation system since it was constructed in 1956-57. The movements are the result of expansive strata beneath the south end of the structure. A peculiar site geology, alternating layers of shales and sandstones with some

[31] United States Department of the Interior, National Park Service - development/study package proposal (form 10-238 02-11-92.)

limestone dipping south at an angle of 65 degrees aggravates the building movements. The National Park Service (NPS) has undertaken several major stabilization projects, including limited foundation underpinning in 1967 and water pipe relocation in 1983, in addition to its continuous minor maintenance efforts. The structure is still moving and approaching an unstable condition."[32]

This building was constructed in 1956 with a foundation consisting of continuous footings and isolated pad footings designed for a maximum allowable bearing pressure of 4000 psf. Shortly after construction the building experienced continuing problems with movement of its foundation. This has caused shifting, cracking, and differential movement throughout the structure. With this movement the engineering design and loading has also shifted causing unknown damage to the integrity of the structure. Numerous attempts to stabilize the structure at present have failed. Structure and surrounding area has had detailed analysis done by private engineering firms, Denver Service Center and regional engineers. Structure as of last inspection (FY90) noted building is safe to occupy but must have major rehab for continued public and visitor safety. Without the completion of this package the building will reach unsafe conditions and the NPS staff and visiting public will not be allowed to enter.

The chief of the Division of Safety and Environmental Services traveled to the park to familiarize himself with the problems associated with the park's facilities and their potential impact on visitor and employee safety. By this point, the building's deterioration had reached a critical juncture. "The visitor center/office building exhibits severe structural deformation. The walls immediately above the exterior perimeter of the foundation are being pushed away (outward) on both sides. The masonry is cracked and floor joists are bent and split in several areas due to increasing pressure as the structure "moves". The floor in one office is so sloped that the employee occupying it has experienced back problems. Attempts to level the floor has [sic] been only partially successful. This is the most obvious safety/health problem associated with this facility but other physical and/or psychological problems associated with working in this

[32] (Amendment of Solicitation/Modification of Contract, Work Order No. 11, National Park Service, Denver Service Center, September 07, 1989.)

environment may emerge."[33]

The Associate Regional Director informed the superintendent that it would be necessary "to remove the surface splash block and paving at the south and west walls of the Quarry Visitor Center along the maintenance access road. All surface covering immediately south of the building must be removed and continued west at least twenty feet from the west wall. Beyond this point to the west, paving removal may be necessary in order to facilitate grading of the entire area and to extend a future subsurface drain to the west. This will be constructed for the purpose of drying the foundation soils. A minimum of three percent grade away from the building shall be constructed….In order to take advantage of the drying affects of the summer months, you should begin as soon as possible."[34]

Conclusion

The Dinosaur Quarry Visitor Center was designated a National Historic Landmark in August of 2001. Although a few years shy of its 50th anniversary, the building was nominated for its significant contributions to the broad patterns of American history and its exceptional importance to the evolution of American architecture, particularly American modernism and Park Service Modern design. The building also has been a millstone around neck of the National Park Service since shortly after its completion. It is without doubt a magnificent structure erected almost literally on a foundation of sand.

[33] Chief, Division of Safety and Environmental Services, RMR - Trip Report, Dinosaur NM August 23-24, 1993 (October 3, 1993)

[34] Memorandum: Associate Regional Director (Acting) Park Operations to Superintendent, Dinosaur National Monument. Subject: Removal of asphaltic concrete paving an concrete splash block adjacent to and south of the Quarry Visitor Center south wall.

Chronology of Development and Use

Note: The following information has been obtained from National Park Service files and compiled by a number of different sources within the service.

11/01/55 "Quarry Area Utilities, Part of the Master Plan, Dinosaur National Monument", Drawing Number NM-DIN/3122A. Landscape Architectural Branch, Western Office Division of Design and Construction.

08/31/56 "Visitor Center – Quarry Site, Preliminary Drawings", NM:DIN/3102-D. Anshen and Allen Architects. Signed by Conrad Wirth, Director of the National Park Service, and father of the NPS Mission 66 program.

11/01/56 Dames and Moore Building Foundation Soils Investigation. (See 05/17/66 "Proposal, Investigative Studies, Adverse Settlement, Visitor Center Building, Dinosaur National Monument. - Previous Investigation").

- A somewhat limited (preliminary) foundation investigation.
- Four shallow test pits.
- "Under undisturbed non-weathered conditions, both the shale and sandstone are rock-like in character. When subjected to water, the shale loses strength. Water present in the shale at the time of freezing will cause expansion of the shale. Movement of sandstone or freezing will be limited largely to ice action in joints and cracks".
- "The need for protection of the foundation from moisture infiltration was stressed prior to construction."

12/29/56 "Visitor Center – Quarry Site, Construction Drawings", NM:DIN/3102-E & 3112A. Anshen and Allen Architects of San Franciso, California.
See "Mission 66 Visitor Centers" by Sarah Allaback for construction narrative.

04/05/57 Contract No. 14-10-232-196, Visitor Center, Quarry Area Dinosaur National Monument, was awarded to R. K. McCullough Construction Co. of Salt Lake City, Utah. The contractor moved on the site and began construction on May 1, 1957.

11/15/57 "Visitor Center – Quarry Site, Construction Drawings", NM:DIN/3102-G. Anshen and Allen Architects.

05/09/58 Quarry Visitor Center was completed and accepted.
Total Floor Area = 18,060 SF at a cost of $366,154. (1960 Completion Report.)

06/01/58. Quarry Visitor Center was dedicated.

03/20/59 Exhibit Layout – Visitor Center – Quarry Site, Construction Drawings,

NM:DIN/3102-F. Anshen and Allen Architects.

04/28/59 Completion Report of Construction Report for Visitor Center – Quarry Area. Superintendent, Dinosaur NM.

08/22/60 Contract to Repair and Remodel the Visitor Center Roof and Completion Report, Maintenance Supervisor, Dinosaur NM.

- Circular Admin. Wing roof rehabilitated with one center drain, insulation, flashing, and roofing replacing 3 original perimeter roof drains. (One perimeter roof drain not disconnected from high roof drain. Condition problem found at a later date.)
- Circular Admin. wing roof connection to Exhibit Shelter wall reworked for better drainage.
- Exhibit Shelter excess asphalt deposits removed and roofing partially reinforced with metal batten strips for wind protection. (Wind damage in 1959.)
- Exhibit Shelter copper roof expansion joint cleaned and sealed.
- Exhibit Shelter built-up asphalt roofing replaced.

02/14/62 Memorandum - Damage...Circular Element…Roof, Maintenance Supervisor , Dinosaur
NM.

- Severe roof leak poured 75 to 100 gallons of water through upper and lower lobby of the Administrative Wing of the Visitor Center on February 8, 1962.
- Roof drainage work done on the Administrative Wing in 1960 was not properly completed. Exhibit Shelter roof water drained to grade by a 4" diameter pipe located just inside the east wall. One of the original three perimeter Admin Wing drains was still connected to the Exhibit Shelter roof drain.
- A new site French drain line under construction for both roofs on the building east side had frozen and backed up through connected drain pipes to the Admin Wing roof.
- The consequently plugged and rerouted high roof drainage then drained out the west valley of the Exhibit Shelter roof on to the ground next to the main column B1 foundations for a number of months.

05/14/62 Memorandum – Inspection of damage and proposed repairs, Supervising Structural Engineer, RMR.

- The damage to the building was caused by wetting of the bentonite soils under the footing of Column B-10, the north jamb of the driveway doors at the east end, the footing under the west wall of the mechanical equipment room and under the gallery slab at the lower level and near the east end of the building.
- The wetting of the soils was caused variously by washing down the lower gallery, frozen roof drains at east end causing water to collect at east end of building and the unfinished paving job started last September.

08/16/62 Visitor Center Plaza Reconstruction, Construction Drawings, NM:DIN/3149C, Western Office Design and Construction, NPS.

- Installed ramp metal handrails.
- Replaced ramp steps with paved walk and ramp extension.
- Installed cobble stone concrete slab around ramp to facilitate site drainage.
- Installed paved walk, curb, drive, and service road to facilitate site drainage.
- Installed subsurface site open joint French drain lines with catch basins on three sides (E, W, and S) of the building exterior.
- Installed parking lot metal pipe guardrail.
- Exhibit Shelter roof drainage system continues to drain to building east.

11/21/62 Memorandum – Report of Interview with Asst. Dir. Baggley, Museum Geologist, Dinosaur NM.

- Original hoist was hand operated. Geologist suggests electrified hoist.
- Gaps between the cliff exhibit and foundation wall. Suggested laid up masonry to fill the gaps.
- Puddles of snow melt against the north side of the building. No suggested remedies.

02/15/66 Memorandum– Emergency Repairs of Sub-floor Waterlines…, Chief of Area Services, Western Office Design and Construction, NPS.

- Recommendations made for repair of problems investigated.
- East wall ¾" water line broken and leaking over long period of time noted. Repair.
- Crack in Lobby floor slab is expanding. Excavate and replace slab.
- Replace 3 cast iron water gate valve boxes on the 8" water main in the Exhibit Shelter driveway with larger boxes.
- Repair and replace Mechanical Room inoperative floor drains.
- Repair roof leaks with tar.
- Ground surface around ramp piers bulging upward causing pavement to crack, piers to rise, and ramp cracks. Replace broken cobble pavement with bituminous pavement, chip, and seal.
- Seal ramp structure cracks.
- Seal upper ramp drainage scupper and pipe lower drainage scupper to the east drain line.
- Water appears at quarry wall cracks. Re-grade north hill away from building.
- Vitrified clay pipe roof drainage line at east end of building cracked. Replace clay pipe drain with steel pipe.
- Concrete parking lot curbs are disintegrating. Correct later.
- Paved entrance road is very unstable. Cracking a constant problem.

03/18/66 Memorandum – Visitor Center Damage Inspection, Chief Engineer, D&C, SSC, NPS.

- East wall water line break caused east wall movement and exterior paved surfaces to heave.

- Suggestion made to re-level or realign paving slabs with injected oil into soil below slabs and drive heavy equipment over the slabs. Environmental degradation?
- Suggestion to re-align underground drains to south side of building under service drive or parking lot.
- Suggestion to replace the mechanical room floor slab because of heaving and inoperative floor drain.

04/27/66 Memorandum – Quarry Center Problem Analysis, Civil Engineer, D&C, SSC, NPS.

- Proceed with emergency repair work proposed in the construction drawings and specifications prepared previous to this memo.
- Water supply at Quarry shows signs of minerals in the water which clog and corrode heaters, piping, and appurtenances. Talk to manufacturers for suggested solutions.
- Extreme summer and winter temperatures coupled with lack of ventilation affect workmen on the face of the quarry wall. Experiment with evaporative coolers and infra-red unit heaters mounted on the traveling crane suggested.
- The existing Quarry water supply tank in its present location constitutes an intrusion on the landscape. Location survey and estimate needed.
- New lower roof mounted fire siren suggested.

05/17/66 "Proposal, Investigative Studies, Adverse Settlement, Visitor Center Building Dinosaur National Monument" – Dames and Moore, Consultants in Applied Earth Sciences.

- A proposal for investigative studies of apparent settlement problems at the Visitor Center Building.
- The damaged area of the building is generally limited to…the lower portion of the east end wall.
- A number of large glass windows have broken each year.
- Separation in the lower portion of the wall approximately two inches wide.
- Necessary to shorten doors to make them function properly.
- Several structural members are severely strained and show evidence of buckling.
- Sidewalks adjacent to building have been replaced at least once and now are offset at the joints by as much as three to four inches.
- Cobblestone area beneath the spiral walkway and adjacent to the building has sheared and is offset vertically approximately five to six inches.
- Support piers for walkway appear to have settled slightly.
- Walkway has moved at the joint where it connects to the building
- Slight cracking of internal non-bearing walls.
- Floor slab shows evidence of cracking in building but does not appear serious.
- Boiler room floor slab shows evidence of more serious cracking.
- North wall, on sandstone, at upper level has a few hairline cracks but nothing serious.

- South wall does not appear to be damaged.
- Traveling crane appears to be functioning satisfactorily but has slight distortion at the center of the track.
- We understand that the building has never performed according to design expectations.
- Settlement and stress in the east end wall was noted soon after construction.
- The area immediately adjacent to the spiral walkway on east end was not paved until after some distress appeared.
- Roof drainage downspout on the west end was originally allowed to empty adjacent to the foundations. Downspout moved after minor distress appeared.
- East end wall, tile drainage line from roof, recently uncovered, shattered and ineffective.

06/03/66 Memorandum – Quarry Visitor Center Repair, Superintendent, Dinosaur NM.

- Temporary repairs under contract M. Rasmussen, Vernal, Utah, will begin.
- Smooth up the entrance walk area for safety.
- Replace broken windows
- Repair leaky roof drains

06/24/66 Repair Buildings – Dinosaur Quarry Area, Construction Drawings, NM-DIN/2046-A, Maintenance Division, Midwest Regional Office, NPS.

- Re-graded ground on north & south side of building for better site drainage.
- Realigned the pavement slab surface at east plaza.
- Changed Exhibit Shelter roof drainage system to drain to driveway south of the building by connecting upper Exhibit Shelter roof drains to lower Lab Wing south roof drainage system.
- Installed galvanized steel pipe for roof drainage across site from building and into south driveway, east down the driveway, to catch basin #2.
- Built drain inlet #1 on said pipeline.
- Cut French drain from west into said inlet.
- Installed drainage inlet #2 beneath lower ramp scupper and plugged upper scupper.
- Extended galvanized steel pipeline to drain inlet #2.
- Repaired Boiler Room floor drain.
- Re-glazed 13 damaged windows.

07/01/66 “Results of Pressure Test on Water System at Visitor Center” , M. Rasmussen, Consultant General Contractor, Vernal, Utah.

- Cold water system leaks approx. ½ gallon per hour.
- Sewer from upper lobby restroom leaks 14 gallons per hour.
- 8” site water line on west side of building leaks 6 gallons per hour.
- Building supply valve dripping water.

07/14/66 “Report of Investigative Studies, Adverse Movement”, Dames & Moore, Consultants in Applied Earth Sciences, Job No. 2050-014-06.

- Seven test borings in and around the building area.
- Laboratory test results on test borings to depths ranging from 5 to 60 feet below existing ground surface.
- "…building is founded upon the Morrison formation which consists of alternate layers of shales and sandstones with some limestone….The stratification dips to the south at an angle of approximately 65 degrees with the horizontal. The strike of the formation corresponds approximately with the alignment of the longitudinal axis of the building. The upper foundations for the north wall of the building are supported on a layer of sandstone. However, at the lower levels of the building, the sandstone is overlain by shale."
- "In general, the sandstone layers are quite hard and resist weathering. The shale formation is quite firm to very hard with few fractures. However, when exposed to air or moisture the shale loses strength and slakes."
- "Bentonitic shales were noted in the shale strata. Bentonitic shales are moisture sensitive; that is they exhibit large changes in volume with changes in moisture content…"
- "A layer of limestone was found…. This corresponds with the approximate location of "sinkholes " observed … at the time of construction."
- Opinions of the cause of adverse movement.
- Recommendations for damage correction and damage cause elimination methods.
- Note: The traveling crane seems to be functioning satisfactorily.

08/31/66 Memorandum - "Emergency Repair…", Superintendent, Dinosaur NM.

- The east wall of the quarry visitor center has shown distress.
- Vertical steel columns have deflected.
- A concrete wall has been pulled free of the column.
- 15 panes of the window wall have broken.
- Double entrance doors and interior doors have repeatedly jammed shut.
- Temporary repairs to provide minimal public safety…were made during late May and June. Repairs have begun to fail in portions of the entrance walk.
- We urge plans and specifications be expedited…

12/13/66 Memorandum - "…Proposed Emergency Repairs, Quarry Visitor Center…, Chief of Maintenance, MWR.

- The eastern most main column is being tilted and bent by upward forces exerted against it by expanding foundation material.
- The roof has developed leaks.
- The concrete slab at the eastern extremity of the lower observation gallery is buckled and fractured by the up-thrust that tilts the column.
- Floor covering on the upper gallery, has been damaged by the roof drainage.
- Water lines located under the floor were broken by the said upthrust.
- The front plaza concrete sidewalks and the cobble surfaced concrete pavement on the plaza were fractured by the movements of the sub-grade materials.

- Clay pipe lying beneath the pavement for disposal of roof drainage was fractured…
- Snow melt and storm runoff from the inclined ramp and adjacent paved surfaces entered beneath pavement…through fractures in the slab…
- Imperative to keep service driveway surface impervious to moisture. Surface has been cut for installation of the new roof drain line. Possible water penetration.

07/27/67 Memorandum – Study proposed repairs…to Visitor Center…to facilitate issuance of bids…, Civil Engineer, D&C, SSC, NPS.

- Extend only the lower lobby. Clear glass to be used in east end wall panels rather than opague plastic. Ventilators to replace fixed glass shown on Drawing No. NM-DIN-3330.
- Construct the column foundation stabilization and doorway foundations as shown on Drawing No. NM-DIN-3330.
- Do not remove or relocate the water lines.
- Repair main collection sewer line under lower lobby floor.
- Install dresser coupling on roof drain line at center point.
- Repair main roof by installing metal strips and apply 3-ply built-up roof.

09/06/67 Repairs to Visitor Center, Quarry Site, Construction Drawings, NM-DIN/3330-A, Revised 04/68, D&C, SSC, NPS.

- Stabilized column B10 by replacement of existing footings with 40' caissons, grade, and tie beams.
- Stabilized east and west driveway door columns by replacement of existing footings with 20' caissons and grade beams.
- Horizontal and vertical building elements aligned with hydraulic jacks. Doors replaced.
- Repaired Exhibit Shelter roof by installing additional metal strips and new 3-ply built-up roofing.
- Extended the lower level Lobby to the north with metal window wall and lower east wall of opaque window wall panels into the Visitor's Gallery. Improved visitor circulation. Included replacement of the concrete floor slab in the new lobby extension and replacement of floor finishes in the existing lobby.
- Extended the upper level Visitor's Gallery floor with handrail to the east window wall. Improved visitor circulation.
- Restored east driveway doors and lobby doors to working condition.
- Replaced several fixed sash windows on the east and west wall elevations with operable sash for better Exhibit Shelter ventilation.
- Removed hose hydrant at base of column B10.
- Repaired main collection sewer line under lower Admin wing floor.
- Removed and rerouted fire hose cabinet 2-inch water line in first floor lobby.
- Repaired Exhibit Shelter roof horizontal drain line with slip coupling.

- Note: The hot water radiant heat pipes in the floors of the quarry galleries are no longer being used.

03/25/68 Change Order No. 1 to Contract No. 14-10-7-971-116 dated 01/22/68, Construction of Repairs to Visitor Center, Chief Contract Administration and Construction, SSC, NPS.

- Remove and replace vinyl asbestos floor tile in existing lower floor lobby, approximate area 1,100 sq. ft.
- Remove and replace the concrete floor slab in the new lobby extension, including the portion extending beyond and supporting the handrail. Approximate area 280 sq. ft.
- Disconnect and remove hose hydrant located at base of column B-10. Provide drain at low point and access door in plywood paneling…
- Substitute "Mirawall" opaque panels in lieu of plate glass in the areas below the horizontal mullions placed at handrail height in the lower lobby.
- Remove and reroute the 2-inch water line to the fire hose cabinet in the first floor lobby.
- In lieu of replacing all of the 4-inch sewer line beneath the floor, expose and test the line beneath the floor and repair and replace with ductile iron pipe, using dresser couplings, the broken section of pipe found outside the foundation wall. Also provide a sleeve of 8-inch pipe through the foundation wall…

02/01/69 Reconstruction Plaza & Entry Walks, Quarry Area, Construction Drawing Number 122/41,001, D&C, SSC, NPS.

- Replaced existing concrete cobble surface near ramp with gravel over asphalt.
- Replaced existing concrete walk near ramp with bituminous walk with chips.
- Installed inlet sump near ramp, repaired drains, and extended a parking lot drain pipe.

06/15/72 "Painting Exterior, and Partial Painting of Interior, Quarry Visitor Center", Specification, Bid Material, Superintendent, Dinosaur NM.

- Painted complete exterior and partial interior of the Exhibit Shelter portion of the building.

09/01/76 "Report on Survey of Environmental Health Facilities", J. McCutchen, NPS Consultant, Public Health Service.

- Sewage Disposal. Sewage from the VC is discharged to a 3,380 gallon concrete septic tank located in the parking lot, and the effluent flows by gravity to dual dosing siphons and trench beds located near residence #46 in the residential area. A new sewage system is under construction at the present time.
- Solid Waste. Solid waste from the quarry area is hauled to Vernal, Utah for disposal in the City landfill.
- Water Supply. Water for the VC is supplied by a 6-inch drilled, encased well and submersible pump, 900 feet deep, located about 500 feet north of the

parking area. The water is metered, chlorinated, and pumped to a 50,000 gallon steel reservoir located about ¼ mile northwest of the well, from where it is distributed to the system. A new water line has been installed from the Jensen, Utah water supply. After the present construction is finished all water will be supplied by this line, the well will be used as a standby.

05/01/78 "Reconditioning Road, Parking Areas and Resurfacing Visitor Center Road Plan", Construction Drawing Number 122/41,024A, Denver Service Center.

- Quarry Visitor Center 4" bituminous concrete parking lot and bituminous peripheral walk installed.
- Service road is indicated as bituminous.
- Wood handrails, timber curb, wood benches installed east of Quarry Center.

06/14/78 Memorandum - …Review of Roads…, Chief of Division of Maintenance, RMR.

- The quarry building is undergoing additional movement this year that appears to be different from that previously experienced. The southerly footing wall is being pushed away from the building proper causing ½ inch gaps in concrete block and in wallboard on the interior. There appears to be a very large sized fault visible outside of the building in the driveway extending on up the hillside and under this portion of the building…
- The Chief of Maintenance needs to re-roof and insulate the quarry area buildings.

01/13/83 Memorandum – …technical assistance for correcting water line breaks beneath the Quarry Visitor Center, Environmental Engineer, Branch of Buildings and Utilities, RMR.

- In 1982 and early 1983, the 8-inch waterline broke three times; twice approximately 25-30 feet from the west door and the latest break 10 feet from the east door.
- The latest break sheared the pipe in two. The other breaks consisted of one shear and one puncture type.
- Water from the latest break caused extensive damage and severe soil deformation problems: (1) Large crack in pedestrian access ramp to visitor center; (2) separation of access ramp from visitor center; (3) crack and heave in first floor of visitor center; (4) severe deformation of west service door frame; (5) numerous windows popped out; (6) one-half inch wide crack in asphalt outside of east pedestrian door.

03/21/83 Memorandum - Building inspection to evaluate damage caused by recent shifting, General Engineer, Branch of Buildings and Utilities., RMR.

- "After the repair and modification (1967), the building was relatively stable with some constant shifting causing windows to shift and crack and doors to bind creating constant repair work."
- In 1982 and early January 1983, several breaks occurred in the 8-inch diameter water line which ran underground just north of the lower observation

area and at the foot of the quarry. When this break occurred it saturated the gravel bedding below the concrete floor quickly reaching all areas below the floor. This allowed the bentonite to become saturated and to expand causing considerable movement and damage to the building.

- (Trip Report by Ann Hitchcock, Chief Curator, October 15, 1985, states that the water pipe breaks happened once in 1983 and twice in 1984. The amount of water released was approximately 400,000 gallons.)
- Immediate 8" diameter pipeline repair included placing the waterline in an accessible, drainable, and below ground, pre-cast concrete, insulated pipe chase with pressure-reducing and shut off valves.
- Water from the latest break caused extensive damage and severe soil deformation problems including:
- Access ramp separated from the visitor center.
- Column B10 lifted and in turn lifted the entire east glass window wall creating a crack between the bottom of the window wall and the concrete foundation wall.
- Severe deformation of east and west service door frames caused the doors to bind.
- Numerous windows popped out of the stressed window walls.
- Concrete floor slabs in the lower lobby, library, and work rooms cracked and raised unevenly causing shear cracks in the interior walls and doors to bind.
- The asphalt surface has cracked outside the east pedestrian door.

10/15/85 Memorandum - Chief Curator, NPS.

- Several actions have been taken to improve collection preservation.
- Fire detection and suppression, and security systems have been installed.
- Halon 1301, in the park library and Paleontological Library.
- Fire sprinkler system in the laboratory.
- An intrusion (motion) detection system has been installed throughout the Quarry Visitor Center and is tied into the telephone dialing alarm system.

11/11/85 "Conduct fieldwork for the National Historic…Landmark Theme Study…", Arch Historian, SWRO.

- Fieldwork for National Historic Landmark Theme Study on "Architecture in the Parks". Quarry Visitor Center does not qualify. Possible qualification for National Register of Historic Places.
- Building changes over time noted include installation of a 1984 fire suppression system.
- Steel posts are separated from their concrete footings.
- Cleveland tram rail crane and hoist no longer function as intended.
- Wood platform addition on the first floor of the quarry.
- Partition changes in office spaces.
- A fiberglass Stegosaurus by the entrance ramp.

- Replacement of east metal service doors with T-111 wood partition wall.
- Removal of concrete cobble surface below ramp and removal of ramp steps (1962).
- Realignment of vertical and horizontal structural members and addition of concrete pilings under critical support areas (1968).
- Extension of upper and lower viewing galleries (1968).
- The building's architectural and structural integrity have been slightly compromised by some of those changes making it of less than national significance at the present time.

05/21/86 Memorandum - Structural Integrity of Quarry VC…, Facility Manager, Dinosaur NM.

- Mention of 1985 installation of a fire/intrusion system in the Visitor Center.
- Building continues to move. Floor cracks have widened, new cracks have appeared, doorways have moved several degrees out of plumb, broken structural beam welds, and the ramp is still cracking and moving away from the building.
- Facilities Manager requests an evaluation by a structural engineer.

03/20/87 Memorandum – Quarry Repair and Stabilization Work, Facility Manager, Dinosaur NM.

- …obligated $6,000 to the DINO Maintenance Division for the emergency repair of the Quarry VC roof.

05/04/87 Memorandum - …visually inspect the structural distress in the Quarry Visitor Center…, Bruce Keller, SE, DSC.

- For the past 30 years, stabilization and maintenance efforts have concentrated on trying to preclude moisture from getting to the underlying expansive strata…Although these efforts have slowed the rate of movement, they have not eliminated movement…it may not be possible to prevent further deterioration of the expansive shales…altering the building to adapt to the site geology will require some reconstruction…
- Public entry ramp is in very bad condition…provide temporary shoring support at its junction with the main building to ensure its stability.
- Elevated visitor gallery is currently safe but in jeopardy of losing support unless current conditions are altered to prevent continued uplift of the building's south wall.

Appendix A: Structural Inspection of the Quarry Visitor Center – May 1987

- In depth study of entire structure and its problems. Bruce Keller, DSC. New adverse conditions include the following.
- Condition of Exhibit Area. Structural distress.
- Condition of Entrance Ramp. Structural distress.
- Condition of Employee/Laboratory Area. Other distress seen in the building is caused by the uplift of the south wall of the employee/lab area and the adjacent visitor contact unit. The uplift of the south wall has lifted the south

end of the roof beams which bear on masonry pilasters built into the south wall. Two masonry roof/floor beam support pilasters are cracked.

- Condition of Employee/Laboratory Area. The roof over the south portion of the building was originally constructed to drain to the south wall at a slope of 7 inches in the 20-foot width of the roof. The roof presently slopes to the north and ponds water on the roof adjacent to the south wall of the exhibit area.
- Condition of Employee/Laboratory Area. Every wall along a north-south axis in the south portion of the building displays diagonal shear cracking.
- Condition of the Visitor Contact Portion. It has experienced uplift similar to that of the south wall. The building is very rigid due to its well reinforced perimeter wall. Therefore, cracks are well distributed.
- Condition of the Visitor Contact Portion. The roof now ponds water against the exhibit unit south wall.
- Surrounding Site Conditions. Both north and south building site drainage of the site is suspect. Continued soil expansion should be expected despite additional control of site moisture.
- Because the building's continued movement may soon jeopardize the safety of the visitor gallery, a program for stabilizing the building needs to be developed as soon as possible. …the entry ramp must be temporarily shored immediately and monitored closely until it can be repaired or replaced.

09/26/88 Memorandum – Park Briefing on Quarry Center Problems…, Chief (SE), General Engineering Section, DSC.

- …a third masonry pilaster has cracked to the extent that beam support is jeopardized….This indicates the south wall is still unstable and the structural strength of the visitor gallery support system is being reduced.
- The concrete entrance ramp broke from its support at the building entrance threshold several years ago….The supports the park staff installed (since the 1987 trip) looked very adequate…(provides) support for the upper end of the ramp…
- The ramp slab is still lifted off the top of the second lowest support pedestal. The ramp sags between the lowest and third lowest supports but does not bear on the broken pedestal at all. The fracture of the pedestal exposed several steel reinforcing bars and spalled some concrete around the fracture area.
- On the south side of the lab building, two French drain systems connect into the same storm sewer system as the roof drains.
- The existing 2-3 foot wide concrete walk/splash pad adjacent to the lab building addition has shifted and currently directs water toward the structure.
- The maintenance personnel indicated that they were unable to rod more than 10 feet of the sanitary sewer service line on the south side of the lab addition before encountering an obstruction.

03/07/89 Memorandum – Briefing for RMR SE on Building Condition, Structural Engineer, DSC.

- A fourth cracked pilaster discovered indicates south wall is still heaving and that all 16 anchorages are likely near cracking stress.
- Buckling of second floor ceiling gypsum board panel in cylindrical two story visitor contact space indicates differential foundation movement.
- Formation of two new diagonal shear cracks in the exterior masonry wall at the southwest edge of the cylinder indicates differential foundation movement.
- The safety of the visitor entrance ramp is again questionable as the result of newly developed sinkholes at the site and further structural damage to the ramp supports.
- The roof over the employee/lab rooms does not drain water toward the exterior wall due to uplift of wall.
- Site French drains are contiguous with the roof drain system allowing water to drain to the soil near the building.
- A concrete walk/splash pad adjacent to the south wall of the lab wing drains water to the building foundations.
- Maintenance road at south side of building does not adequately drain the site away from the building.
- Sanitary sewer adjacent to the south wall suspect.

03/30/89 Memorandum – Integrity of water, sewer, and drain piping…, Chief Div. of Construction and Maintenance, RMR-ME.

- Parking area in the vicinity of the east entrance is settling.
- Vicinity of the entrance ramp shortest pier is settling.
- Pedestrian ramp's shortest pier has spalled more concrete.
- Five glass panes in the wall south of the elevated visitor's gallery have cracked.

04/27/89 Memorandum – Ramp Closure, Superintendent, Dinosaur NM.

- The ramp has been closed.
- The ramp must be investigated and shored up to allow use, even if temporary, by May 20, 1989.

05/01/89 Memorandum – Ramp Closure, Regional Director, RMR.

- Concurrence of closure of quarry visitor center's entrance ramp structure to visitor traffic.

05/03/89 Memorandum – Foundation Exploration of Quarry VC, CE, Branch of Roads and Architecture, RMR.

- Excavation of ramp pier 3 area with backhoe. No conclusions.
- Circular roof center drain flows to the sanitary sewer.
- Circular roof east drain daylights at ground level.
- Circular roof other drains flow to storm sewer system.
- Water ponds on top of the circular roof over an area against the quarry building.

- Excavation at circular building footing revealed supersaturated state soil and void approximately 12 inches deep.
- Excavation at southwest corner of the quarry lab exterior revealed paving, and below that French drain, granular fill, and interceding plastic film barrier between drain and south wall.

05/07/89 Memorandum – Quarry VC Inspection, Structural Engineer, DSC.

- …a fourth masonry pilaster with a crack that compromises the anchorage of the fastened steel roof/visitor deck framing beams.

05/10/89 Memorandum – Stabilization and Repair of Three Structures…., Asst. Mgr., Central Team, DSC.

- Repair to Quarry VC visitor gallery deck and south roof is necessary because the roof currently slopes toward the south glazing wall of the quarry exhibit space.
- Structural solution for cracking south wall pilasters is necessary to anchor the visitor gallery deck beams. Three alternative schemes included from DSC.

05/11/89 Memorandum – Closure of Quarry Visitor Center Ramp, Asst. Mgr., DSC.

- The ramp is expected to be opened on 05/19/89 after temporary remedial work has been done.
- Rehabilitate grading and drainage at south wall of Quarry Visitor Center.

05/25/89 Memorandum – Details for Monitoring Relative Elevations of South Wall of Quarry Visitor Center, South Wall of Lab and Conference Room.

- Bolts and Whitimore Points to be installed for future measurements.

05/23/89 Memorandum – Selection of Recommended Alternative for the repair of the Quarry visitor gallery deck support/south roof...Assoc. Regional Director, RMR.

- Regional recommendation is Alternative C rather than the park's choice of Alternative A (05/31/89).
- Alternative C involves installing supplemental anchorages to anchor the existing steel roof/visitor gallery deck beams to the masonry pilasters along the south wall.

05/25/89 Memorandum – Removal of asphaltic concrete paving and concrete splash block adjacent to and south of the Quarry Visitor Center south wall - ARD, RMR.

- Remove the surface splash block and paving at the south and west walls of the Quarry Visitor Center along the maintenance access road…to dry foundation soils.
- A minimum three percent grade away from the building shall be constructed.
- Project DINO S02, Stabilization/Rehabilitation of the Visitor Center….

06/07/89 Report – Mitigation of Drainage and Utility Deficiencies – DSC, Park, and Martin & Martin.

- Drawing Details (8-1/2" x 11") are included. Recommendations include:
- Replace existing under ground drain lines on south & west side of building.
- Remove and replace concrete splash pad on the south side of the building.
- Excavate sanitary service outfall line and replace from the building line outward.
- Re-grade service drive and ditch.

07/24/89 Memorandum – Visitor Gallery Deck Anchorage Repair – Structural Engineer, DSC.

- Details and cost estimates for 2 temporary ballasting solutions submitted.

08/31/89 Memorandum – Water and Wastewater Field Evaluations - Chief of Professional Support Division, DSC.

- Work has been completed on portions of the water lines either by abandoning unneeded water lines or placing water lines in utility chases (pre-cast concrete). Water lines that remain need attention.
- The fire hydrant located east of the building has been reported as not closing properly. Currently, the hydrant has been turned off via a gate valve located in the quarry building. The occupied portion of the quarry building has recently had a sprinkler system installed.
- The 2-inch galvanized steel pipe that is buried beneath the concrete floor of the book sales area of the visitor center has the potential for a major leak due to corrosiveness of the soil on metal pipe and the slight aggressiveness of the water on metal pipe (heaving of the existing concrete floor may indicate water seeps may now be present). Recommend that this water service be abandoned and a new 2-inch, above grade water service be installed so that all piping can be easily accessed for observation and leak detection.
- The recently installed fire sprinkler system has a connection to the main water line that is rigid and does not provide for observation for leak detection purposes. Recommend that this connection be rehabilitated to incorporate flexibility and leak detection capability.
- Recommend installation of flow monitoring devices on the water system serving the visitor center. There are none now. Will aid in leak detection.
- On July 12 and 13, 1989, excavations were made along the south wall of the quarry building to locate sewer lines at west end and center of the south wall.
- ¾" hole in west end pipe (1) at concrete stem wall. No sleeve through wall. Based on the condition of the exposed pipe, corrosive soils, and vertical movement of the stem wall, the sewer lines beneath the floor slab in this area can not be expected to maintain water tight integrity.
- Center line (2) is sleeved through wall. The cast iron soil pipe beneath the floor slab is leaking in a severe manner.
- East end of piping at south wall was not excavated. Cast iron pipe under floor was replaced in 1967 by ductile iron pipe and sleeved. Exterior cast iron pipe replaced in 1988 by PVC pipe to manhole. Should be tested.

- Exterior cast iron sewer lines connecting 1 and 2 to the manhole will be required to be replaced with a flexible piping material such as polyethylene. Replace the existing exterior cleanouts with manholes.
- The 6-inch sewer line connecting the manhole adjacent to the information center to the manhole at the edge of the parking lot will require cleaning and video inspection. The park has replaced one half of the cast iron pipe with PVC. The other one half has not been replaced because it runs under one of the piers supporting the pedestrian ramp.
- The French storm drain located 6 feet from and parallel to the south wall of the building is nonfunctional for several reasons. The pre-cast concrete drainpipe was installed at to shallow a depth to intercept groundwater impacting the foundation soils.
- Drain pipe and surrounding 1-inch diameter rock were encased in polyethylene membrane on three sides. It is suspected that the original intent of this French drain was to intercept water from the roof as the roof has no gutters.
- The French drain installed beneath the walkway on the east side of the building was plugged at catch basin No.2 with soil material. Manual cleaning of this blockage by the park has not proven to be successful. It is recommended that new subsurface drainage facilities be installed.

10/16/89 Memorandum – …stakeout geo-tech exploration drill holes and assist the contractor and monument personnel during drilling…,Structural Engineer, DSC.

- Inspection of Chen Northern site drilling operations at the Quarry Visitor Center.
- One boring location inside building deleted because of building impacts.
- Perforated PVC pipe installed in several borings to allow for ground moisture monitoring in future.
- The finding of…the fifth masonry support pilaster with a visible crack in the portion of the pilaster that restrains the steel roof/visitor deck support beams.

10/26/89 Memorandum – Geotechnical Investigation, Branch of Roads and Architecture, RMR-ME.

- Deep interior and exterior drilling done by Chen-Northern, Inc.
- Fourteen drill holes from 13’ to 44’ deep.

11/22/89 Memorandum – Metering System for the Quarry Visitor Center Water Supply Line. Tim Windle, ME, RMR.

- Purchase of two meters and installation details.

12/08/89 Geotechnical Engineering Study, Distress to Quarry Visitor Center, Dinosaur National Monument, Utah. Job No. 1 659 89. Chen Northern, Inc.

- “It is our opinion that the present distress shown by the building is due to continued uplift from expansive claystone bedrock.

- Water leaks from utilities within the building and poor drainage around the perimeter of the building appear to have contributed to moistening of the subsoils with subsequent expansion of the claystone.
- Isolation of utilities from subgrade soils and improvements to exterior drainage of the building may stabilize the structure to some degree.
- Long term stability, however, may require the use of straight-shaft drilled piers to underpin the existing foundation."

10/24/89 Report – "Wet Well Monitoring, Quarry Visitor Center, Dinosaur National Monument." Park staff, Dinosaur National Monument.

- Monitoring continues through 1994.

04/25/90 Memorandum – Rehab/Repair Quarry Visitor Center…, Superintendent, Dinosaur NM.

- The gallery stabilization project has been completed using day labor…(There are no "as constructed" drawings)
- Work included work on dry wall, tie down installation, and reconstruction of walls and shelving.
- Memo includes proposals for utility lines that appear to be aggravating expandable soils under the foundation.

07/02/91 "Water/Sewer Reconstruction – Quarry Visitor Center", Construction Drawings, 122/80045, RMR.

- New west side of building manhole at end of existing 8" waterline. Existing 8" diameter water line which runs through the center of building capped, new exterior 6" diameter PVC waterline located on south side of building to relocated fire hydrant near building east side ramp base.
- New 4" diameter PVC water line from new west side manhole water source to 3" existing diameter fire line in Tool Room.
- Re-plumb existing and new 1-1/2" diameter waterline service to boiler room, lab, toilets, and Administration wing from 3" diameter fireline.
- Replace existing sewage service system with new exterior manholes and 6" diameter PVC pipe.

07/15/93 Report – "Quarry Visitor Center". 1992-1993. Unknown author, Dinosaur National Monument.

- 05/92 – Chisel concrete from the top northwest corner of ramp to allow door to open.
- 07/92 – Eight broken windows replaced.
- 07/92 – Asphalt cracks sealed in front of the VC and in the parking lot.
- 07/92 – Dry wall cracks patched in the west book sales area wall.
- 09/92 – Book sales area door to quarry wall shaved to open and close.
- 09/92 – Site sewer line replaced and re-routed.
- 11/92 – Administration roof leaks water. Roof is sloping toward exhibit building wall. Second floor ceiling is damaged in Administration wing.

- 11/92 – Library west wall is bowed.
- 12/30 – Window broke and fell out.
- 12/30 – Urinal drains are slow.
- 02/93 – Library wall studs cut and interim header installed.
- 03/93 – Double door at quarry east driveway is warped and buckled.

08/23/93 Memorandum – Trip Report, Quarry VC Familiarization. T Windle, CE, RMR.

- Transverse expansion joint at the building middle has opened at the north side and is closing on the south side.
- Water is present and iron valves are rusting in the 1991 manhole at the west end of the Quarry Visitor Center.
- Administration Wing has standing water on the roof and leaks are damaging the second floor ceiling. A roof scupper will be installed.
- Window wall glass pane breakage continues to be a hazard to the visitor.
- Since my last visit to the park, the partition wall between the library and paleontologist's office has been reconstructed.

11/07/94 Report – "Quarry Visitor Center Work 1994". Unknown author, Dinosaur National Monument.

- 01/94 – Maintenance installed suspended ceiling and fluorescent lighting in the upper round gallery of Quarry.
- 02/94 – Quarry roof is leaking in the upper gallery of the V roof. This is in the areas of the expansion joints and down spouts, and the same area that the membrane fabric was installed last November.
- 02/94 – Maintenance has patched the cracks in the interior walls of the stair well and is in the process of painting these areas.
- 04/94 – Routine interior painting…
- 05/94 - …building movement between 6AM and 9AM. Doors became misaligned (entry and gallery doors). Carpet gap in sales area widened. Wall cracks opened. Three windows cracked.
- 05/94 – Jacks under concrete ramp tightened.
- 06/94 – Quarry visitor center roof membrane patched and painted.
- 09/94 - Quarry Visitor Center roof leak. Asphalt shingle roof in poor condition with wind damage. Repaired. Needs re-shingling.
- 09/94 – Lab roof leaks. The roof slopes into the wall of the main building. Leaks again 10/94.
- 11/94 – Safety film applied to windows.

05/01/95 "Pedestrian Bridge Evaluation and Recommendations, Dinosaur National Monument, Utah." Western Bridge Design, Central Federal Lands Highway Division, Federal Highway Administration.

- Following the damage that has occurred to the pedestrian bridge, an analysis was necessary to study the structure in its operational state.
- The results proved that the capacity of the bridge is adequate to carry the loads in its current condition.

07/26/99 Memorandum – Quarry VC Investigation, CR Jones Arch, ISO.

- Historic building color investigation and subsequent color recommendations.

07/26/99 Paint Visitor Center – Quarry Site. Drawing Number 122/80,060.

- Construction Drawings.

01/03/01 National Historic Landmark Nomination

- "We are pleased to inform you that the National Historic Landmark (NHL) nomination form for the Quarry Visitor Center, which was designated by the Secretary of the Interior as a National Historic Landmark on January 3, 2001, has been finalized."

Physical Description

Exterior

Overview

Nestled into a steep hillside of solid rock to protect decades of dinosaur excavations, the overall appearance of the Quarry Visitor Center is clearly a product of its function. The unique juxtaposition of contemporary architectural geometry contrasts sharply with the rugged irregular landscape. The cylindrical mass appears to auger into the site while the butterfly roof soars atop a lattice of glazed walls, the majority of the roof nearly parallel to the excavation. Concrete block, glass, and painted steel predominate.

Concrete block and exposed concrete aggregate natural gray color dominate both the cylindrical Administration Wing (Admin Wing) and the one-story Mechanical, Lab, and Library Wing (South Wing). The window casements in these walls are painted pink.

The Exhibit Shelter wall lattice, exposed roof sheathing and purlins, and muntins are painted pink, in contrast to the primary structural columns, which are painted dark reddish-brown.

Items of Note:

- From a distance, the overall structure appears to be in very good condition. However, upon closer inspection, there are numerous signs of structural displacement, cracks, wall and roof modifications, and glazing replacement.
- Based on a historic color slide (see photo HP11/A), the color of the fenestration, and exposed roof purlins, appears to be pink, matching the current color scheme. However, the exposed roof sheathing in the photo is contrary to how the structure is currently painted. The photo indicates yet another contrasting light color or possibly the fact that it was unpainted (bare wood) when the photo was taken.
- An Evaporative cooler is mounted on the east elevation just to the right of the main column grid B.

Admin Wing

The prominent barrel-shaped mass of the two-level cylindrical Administration Wing is in the forefront of the structure when viewed from the parking lot. This wing connects to the Exhibit Gallery on two levels, and the South Wing on the ground level.

The cylindrical Administration Wing is constructed of unpainted, stacked course, concrete block pilasters with regularly spaced narrow windows in-between. The windows are a combination of fixed transom and lower sash with selected lower sashes operable casements.

Stacked primary entrances are located at the two-story connection between the two level Administration Wing and the Exhibit Shelter.

Items of Note:

- Exterior walls are severely cracked and some window casings are displaced. The cracks are typically through the block and not at mortar joints.
- Both Main double doors are only 5 feet wide.
- Both Main double doors appear to be aluminum replacements and as such their natural silver appearance drastically conflicts with the surrounding pink fenestration.
- Door frames are severely racked to the point daylight and weather can pass through between the door leaves and door frame. Additionally, doors do not close easily and require constant adjustment.
- Exterior evaporative coolers are mounted to two windows on the second floor of the west elevation on column grid 9 and to one window on the south elevation of the first floor.
- There are covered vents below window sills where interior HVAC console units are located. These are currently filled with insulation and covered with plywood.

Serpentine Entry Ramp

The second floor entrance is accessed by a steeply sloping serpentine entrance ramp that wraps around the cylindrical Admin Wing. The second floor entrance is one of the two primary public entries to the structure. The other main entry at ground level is directly below the ramp's termination at the second floor. The combination of the serpentine ramp and cylinder shaped Administration Wing, with their combined circular geometry, visually anchor the much larger rectangular-shaped, butterfly-roofed Exhibit Shelter.

Items of Note:

- Ramp has short (less than 42-inch high, non-code compliant) guardrails.
- Ramp is too steep and long to meet current accessibility standards.
- Ramp has severe structural damage at its supports.
- North end of ramp is supported by visible non-historic structural steel columns and beams.
- The ramp has visible transverse cracks at the side walls.
- Historic steps (4 risers) are covered with concrete, thus modifying the ramp's historic appearance.
- The southeastern most pier (pier 4) is not indicated on the historic drawings.

South Wing

The one story South Wing stretches along the entire south elevation of the Exhibit Shelter. As with the cylindrical Administration Wing, there are displacement cracks visible at the pilasters between the windows, the weakest points of the wall. There are also indications of past repairs. A second roof has been added in order to get the water to drain away from the Exhibit Shelter.

Items of Note:

- Modification of roof to accommodate drainage due to severe settlement.

- Displacement cracks in the south wall.
- Door modification on the west wall. Racking is so severe that wood frame infill and a single-leaf contemporary door have replaced the historic double door.
- Block coursing does not line up on west wall where the South Wing intersects the Exhibit Shelter.

Exhibit Shelter

The Exhibit Shelter is a large glass latticed steel structure with a cantilevered roof on the south elevation. Though it appears as a curtain wall, all the mullions and muntins have welded joints, thus making the entire assembly a rigid structure, similar to a Vierendeel truss. Large, regularly spaced, tapered beams and columns provide primary support, spanning from the leveled lower end of the site to the upper reaches of the of the rock excavation. Exposed concrete foundation walls are set directly on the rock slope.

Items of Note:

- Viewing the east elevation from the parking lot, it is apparent that the glazed steel lattice is deformed and displaced from the concrete foundation wall. The lower left portion of this elevation is racked so severely that the large historic doors have been replaced with contemporary wood infill. Numerous glass panels have also been replaced.
- A large radio mast is attached to the tip of the most easterly roof beam on the southeast portion of the Exhibit Shelter roof.
- Two sets of 3 operable windows are located on the east and west elevations that are not indicated on the historic drawings.

Interior
(See Architectural Condition Assessment for detailed room-by-room Feature Inventory)

Overview

The Admin Wing, South Wing, Admin Wing, and Exhibit Shelter are three distinctly different interior spaces that are still used for the purpose for which they were designed. The spaces tend to be very utilitarian, with the exception of the Administration Wing that has some architectural embellishment with wood paneled walls and tiled restrooms.

Admin Wing

The interior of the Admin Wing, on the first floor consists of access through a connector to the north entering the Exhibit Shelter, a Lobby sales area, central rotunda with winding stair, (112), and offices (114, 115). On the second floor, a similar central rotunda and Lobby Area (202) provides circulation to the winding stair, office (204), and public restrooms (205, 206, 207, 208, 209) and Janitor's Closet (206).

When the current configuration is compared with historic construction drawings, there are apparent modifications to the floor plan on both floors.

A wall has changed position which originally separated offices 114 and 115 on the first floor. The spaces are now office 114 and information 115.

What was once an information counter and small work area (203), in the west quadrant of the second floor, is now a closet and an accretion of space for office (204). The original door, built-in desk, and associated partition were removed and replaced by the current closet configuration and door entry to office (204). The ghost is still visible at the ceiling of the closet. In addition to storage, the closet houses an exhibit which is viewed from the Lobby (202).

Items of Note:

- There are indications of floor slab movements and previous floor slab repairs on the first floor.
- There are visible water stains and the tee-bar components are deformed on second floor ceiling.
- Second floor flooring appears to be water-damaged. There is significant blistering in the rotunda area that can be felt through the carpeting.
- Toilets struggle to flush properly due to wall and floor displacement. Water pressure has been reduced to keep flushing water from spilling on the floor.
- Wall displacement (interior wood framing delaminating from exterior concrete block) is visible at numerous window frames.
- Balustrade spacing on stairs does not meet current building code.

South Wing

Mechanical Room (103)

The Mechanical Room is located at the extreme west end of the South Wing. It contains the mechanical equipment for heating all spaces except the Exhibit Shelter. The room contains the electrical main switchboard and the telephone board. Significant modification of this space, when compared to the historic drawings, are the infill of the double leaf doors on the west wall and the introduction of a new single leaf door at the east end of the north wall to access a store room. This store room is not indicated on the historic plans.

Items of Note:

- The concrete floor slab in this area is cracked and tilted most notably at the north wall.
- The doors on the west wall have been modified by infilling a double door opening with a wood frame wall and single leaf door.
- Supplemental anchor rods are installed at pilasters on the south wall. See structural description for a more detailed discussion of this feature.

Preparation Lab (104)

The Preparation Lab (104) is to the east of the Mechanical Room. This space has been changed little since the building's construction. It still functions much the way it was intended by allowing visitors to see the lab at work through interior windows at the west end of the north wall. Originally there were six lights, but three to the west have been covered up by gypsum wall board. The three covered historic windows appear to be intact beneath these finishes.

The south wall is wood frame with painted gypsum board. A pipe chase runs the entire length of the room, from the floor up to a level of about three feet. Book shelves continue up to the sill of the window band that runs next to the ceiling. All other partitions are wood frame with painted gypsum wall board.

The ceiling has exposed fire suppression piping, steel beams and fluorescent light fixtures with painted gypsum board.

Items of Note:

- The concrete floor slab in this area is cracked and tilted most notably at the north wall.
- Door frames on the north end of the east and west wall is severely racked from structural displacement.

The Corridor (105)

The corridor located along the north side and east end of the South Wing provides access to rooms Staff Toilet (107), Janitor's Closet (108), Paleontologist's office (110), and Library and Conference rooms (111), the Lab (104) from the Lobby (112) which is in the Cylindrical Administration Wing. The corridor has gypsum board ceiling with space above, and ceiling access, at the east end. This ceiling is shown as "exposed construction" on the historic construction drawings and may not be significant. The corridor, in itself, would be unremarkable if it was not for the way it showcases the severe structural racking of this part of the building, evidenced by the doorframes at either end (see photos IN4/A, B, C, D & E)

Staff Toilet (107)

There have been some minor changes in this space when compared to the historic drawings. It appears a toilet partition and a short wing-wall (on the north end of the west wall) was removed circa 1967, and a shower was added. The ceiling has exposed fire suppression piping, steel beams and fluorescent light fixtures with painted gypsum board.

Janitor's Closet (108)

There have been no changes in this space according to the historic drawings with the exception that the service sink was removed. The room has wood frame and painted gypsum wall board construction with a concrete floor. Gypsum board has been removed and the studs exposed on the north and east walls.

Paleontologist (110)

This space is labeled Dark Room (109) and Geologist (110) on the historic drawings. Currently, both of these rooms are combined and used for the Paleontologist's office (110). Additionally, the historic Darkroom (109) equipment and its related partition to the east were removed, and the door between the Corridor (105) and Geologist (110) filled. Due to this modification, there is no longer a room 109.

The south wall is furred out wood frame and painted gypsum board on concrete block with a pipe chase running the entire length of the room, from the floor up to a level of about 3 feet. Book shelves continue up to the sill of the window band that runs next to the ceiling. All other partitions are wood frame with painted gypsum wall board.

The ceiling has exposed Halon fire sprinkler piping, steel beams and fluorescent light fixtures with painted gypsum board.

Items of Note:

- The concrete floor slab in this area is cracked and tilted most notably at the north wall. The floor is tilted so severely that office furniture has to be supported on secondary floor systems that are level. In the transverse axis there is as much as 8 vertical inches difference in fifteen horizontal feet (see photos IN7/B & C)

Library and Conference (111)

The space labeled Library and Conference (111) appears to have changed little when compared to the historic drawings.

The south wall is furred out wood frame and painted gypsum board on concrete block with a pipe chase running the entire length of the room, from the floor up to a level of about 3 feet. Book shelves continue up to the sill of the window band that runs next to the ceiling. All other partitions are wood frame with painted gypsum wall board.

The ceiling has exposed Halon fire sprinkler piping, steel beams and fluorescent light fixtures with painted gypsum board.

Items of Note:

- The west wall illustrates severe structural trauma, past and present.
- The concrete slab, similar to the other rooms to the west, is tilted from structural movement.

Exhibit Shelter (101, 102, 103A, 116, 201)

The Exhibit Shelter is by far the largest and most prominent element of the Quarry Visitor Center

because it does just as the title suggests; it shelters the portion of the mountain where Dinosaur fossils have been excavated. By design, the Exhibit Shelter protects the resource from the elements while allowing for the park visitor to get a first-hand view of current and past work, whether it takes place on the mountainside or in the laboratory.

The structure is constructed primarily of steel, glass and concrete. The only use of wood is for the roof decking. All four walls consist of a welded steel mullion-and-muntin lattice that is glazed with large panes of glass. The wall elements, due to their rigid welded construction, create a very inflexible curtain-wall. Where normally a curtain-wall is non-load-bearing, this assembly performs more like a Vierendeel truss allowing very little flexibility.

The only columns for the interior are located at the exterior walls leaving a clear span of sixty feet in the transverse axis and twenty foot spans with a total of one-hundred-eighty feet in the longitudinal axis. Except for where the South Wing attaches on the south elevation, all of the structural elements are exposed with very little architectural embellishment. The Exhibit Shelter is the essence of form following function.

There is an elaborate system of remote window opening levers, gears, chains, and pulleys (see photo IN23/A, B, & C) for the operable awning type sashes. Much of the operable window opening system appears to be covered with layers of paint, but appears to still function.

Items of Note:

- Cracks in the concrete foundation wall appear in the west, north and east elevations.
- Lateral displacement of the curtain wall where it attaches to the foundation, most notably on the east elevation.
- Deformation of the steel lattice curtain wall, most notably on the east elevation.
- Window glazing putty sampled from broken windows appears to be extremely hard.
- Glass is held in place with approximately eight small wire retainers (2 each side) and glazing putty. The wire retainers are 2 inches long and bent in the middle and at each end. They are designed to snap into holes provided in the metal muntins and mullions (see photo IN23/D). There is vidence of past, and on-going, glass breakage and subsequent replacement.
- Visitor egress from the Exhibit Shelter is limited to the two sets of double doors, one on the mezzanine and one directly below, both at the east end.

Mobile Scaffold System

As a major component of the Exhibit Shelter, there is a Mobile Scaffold System that allows a gantry to move in the longitudinal direction, while an integral scaffold element allows vertical traverses of the quarry slope. The entire assembly moves on two tracks, one attached to the side of the uprights on the north wall, the other on a track embedded in the ground at a varying distance from the toe of the quarry. The Mobile Scaffold System was designed so that several people could have automated access to any selected part of the resource without having the scaffolding bear on the rock. Conveyance is accomplished by electric motors, winches, and pulleys.

Items of Note:

- The scaffold portion is damaged from a recent accident where cables on the east side of the platform gave way and the scaffold was left suspended by the remaining cables on the west side. The steel pipe guardrail is bent at an angle (see photos IN26/A, B, C & G). As this report is being written, the Mobile Scaffold System appears to be unusable.
- Due to structural displacement, the steel track that is attached to the steel columns along the north elevation is uneven, thus impeding the Mobile Scaffold System's traverse.

Lunch Room/Kitchen (101)

This room is the former Tool Storage room that was enlarged by the removal of a partion to the east. A contemporary kitchen counter with overhead cabinets has been installed on the east end of the south wall. A new fire sprinkler riser is located in the northwest corner of the ell-shaped room.

Lower Visitor Gallery (102)

The Lower Visitor Gallery (102) is identified on the historic drawings as the space beneath the mezzanine, defined by where the guardrail limits visitors to the north and the north wall of the South Wing limits them on the south. Storeroom 103 A is at the west end and Lobby 112 is at the east end.

Items of Note:

- There has been significant modification at the east end to increase the size of the Lobby (112). The historic glazed partition and glazed wall was removed circa 1967 and the new partition to the north located just inside the visitor gallery guardrail line. The partition on the west is on gridline 9. See Existing Condition Drawing A1.
- At the west end of the Lower Visitor Gallery (102) partitions have been added to create Storeroom (103 A), just to the south of the open stairway to the mezzanine. See Existing Condition Drawing A1.
- At the west end of the Lower Visitor Gallery (102) the historic tool room (101) has been enlarged by partially removing the east wall. Its new function is lunch/kitchen (101).

Storage (103A)

This room was created by adding new partitions on the west, north, and east walls. Additionally, a single leaf door was installed in the existing partition to the south

Upper Visitor Gallery (201)

A cantilevered mezzanine, labeled the Upper Visitor Gallery (201), runs the entire length of the south elevation. Stair access is at the west end. This mezzanine affords the visitors an elevated view of the quarry.

Items of Note:

- When compared to the historic drawings, there is a modification of the mezzanine floor at the extreme east end where additional flooring was added to make up for a shortfall of nearly 4 feet.
- There is only one pipe (located at gridlines 8 and B) to convey all the roof runoff collected from 6 other locations on the roof valley. All the pipes are approximately 4 inches in diameter. The pipes have no protection (insulation or heat) from freezing in this area.
- The Mezzanine floor is extremely flexible (up and down) and could be susceptible to resonance vibration (if too many visitors were to jump up and down simultaneously).
- The Mezzanine floor appears approximately a foot lower at the center point of the building when one sights the railing from the stair location (see photos IN17/B & C).

Character Defining Features

Exterior Features

Admin Wing

Massing:
- Cylindrical shaped two-story structure with evenly spaced pilasters and windows.
- Fluted appearance.
- Stacked narrow windows accentuate the wing's verticality.
- The cylindrical mass transitions (unwraps) to tangential rectangular geometry where it connects with the other two wings.

Walls:
- Overall cylindrical fluted appearance.
- Stack bond course natural (unpainted) warm grey, concrete block walls.
- Evenly spaced two-block-wide pilaster reveals between windows that run from the first floor windowsill to the flashed parapet.
- Spandrel Panels: Exposed natural color aggregate concrete is visible in the same wall plane as the windows between raised pilasters, above and below first and second floor windowsills and heads.
- At the base of the wall, there is a water table reveal at the first floor finish elevation that runs the entire circumference of the cylinder.
- Plywood covered rectangular vents are located beneath windows on first and second floor where the interior HVAC consoles are located.

Windows:
- Rectangular, slit-like, painted steel (pink) casement and fixed windows.
- Windows are equally spaced on the block module.
- Window proportions consists of two lights, a fixed one in the upper third, an operable or fixed light in the lower two thirds

Doors:
- Both main entries, first and second floor, are completely glazed, one-light each leaf, double doors with fixed transom windows above and sidelights to the Admin Wing side. Door casings, rails, and stiles are unpainted aluminum, sharply contrasting with surrounding painted curtain wall. These doors are obvious replacements and as such their unpainted aluminum appearance would not be character-defining. Historically, the doors were likely a contiguous color scheme.

Roof:
- Flat roof and parapet is visible from adjacent hillside vantage points.
- A circular skylight (plastic) bubble is situated at the center of the round roof.

Serpentine Entry Ramp:

- The base of the ramp at grade level has been significantly modified as the historic stair has been covered or removed, thus making the ramp either longer or steeper than its historic configuration. The steps (4 risers) are character defining since they were originally constructed.
- The ramp hugs the circular mass of the Admin Wing until it nears the grade.
- The base of the ramp at grade widens and winds in the opposite rotation with the guardrails spreading open at the grade entrance.
- Poured in place concrete sloping deck, natural color.
- The walking surface is filleted where it merges with the guardrail walls.
- Contrasting integrated concrete guardrail walls (with standoff unpainted aluminum metal handrail) constructed with natural color exposed aggregate concrete, similar to the material used above and below windows, between pilasters, on the main Admin Wing wall.
- Minimal use of exposed aggregate concrete, flat, fin-like wedge-shaped supports, cantilever the ramp in the transverse axis. Only three of these support columns are used making the ramp appear to float.

South Wing

Massing:
- Rectangular one-story wing that stretches the entire length of the structure, from the Admin Wing to the termination of the Exhibit Shelter

Walls:
- Concrete block, stacked coursing that matches the color and texture of that used for the Admin Wing.
- Evenly spaced two-block-wide pilaster reveals between windows that run from the foundation to the roof eaves on the south elevation only.
- Seven vertical courses of concrete block between pilasters.
- Exposed mechanical equipment and chimney stack.

Windows:
- Ribbon band of painted operable steel sash hopper windows at the upper termination of the wall.
- Two lights between pilasters.

Doors:
- No doors located on the south elevation.
- Single leaf utility door on the west elevation set into an infill of painted wood T-111 (a contemporary modification). Only the overall opening that used to have double leaf doors is character-defining.

Roof:
- Significantly modified from original design.

- Minimally pitched roof with short overhang on the south side only (appears to have contemporary modification to allow it to drain and thus not a character defining feature.
- Rectangular gutter and downspouts.

Exhibit Shelter

Massing:
- Large rectangular steel and glass structure set into the mountainside with an asymmetrical butterfly roof.
- Larger uphill portion (north elevation) of the butterfly roof slopes nearly parallel with surrounding rocky terrain.
- Downhill side (south elevation) cantilevers from the low point of the butterfly.
- Primary columns and beams are painted a dark reddish-brown.
- Secondary purlins, roof sheathing, and wall lattice are painted pink.

Walls:
- Curtain Walls: Steel columns with integrated (all joints welded) steel curtain wall rails and vertical mullions and muntins (painted pink), rise from concrete foundation walls on the west, north, and east elevations to form the walls.
- On the south elevation, the glazed Gallery curtain walls rise from the roof of the One Level South Wing.
- Gallery walls consist of glazing on all four elevations except where covered by connections to the other two wings to the south.
- On the east elevation there is contemporary T-111 plywood infill where a large equipment door originally existed.

Windows:
- See discussion of curtain walls above.
- Square and symmetrical glazing pattern in the field of the curtain wall.
- Upper and lower glazing panels are shaped to match the angle of the foundation and roof at the east and west elevations.
- The majority of glazing consists of fixed glass.
- Operable sashes have thickened muntins and rails.
- Operable window sashes (awning type) are located in selected areas on all four elevations. The north and south elevations were historically the only elevations with operable window sash.

Doors:
- Large, double leaf, painted steel, rail, stile, and panel door on west elevation (historic drawings and photos indicate there was a similar door, located symmetrically, on the east elevation.)
- Door within a door on the uphill leaf of the large doors described above.

Roof:
- Appears to float over semi-transparent curtain walls.

- Exposed structural at eaves: tapered steel roof primary beams, steel transverse purlins, and wood plank roof sheathing exposed at roof eaves, especially the cantilever on the south elevation.
- Exposed beams and roof sheathing painted (pink).

Interior Features

For detailed room-by-room description, see Condition Assessment of interior finishes of all interior spaces.

Admin Wing

First Floor:

Walls:
- The central rotunda provides circulation to the winding stair, offices, sales area, South Wing to the west and Exhibit Shelter to the north. Typically, Rotunda walls are paneled with varnished natural finish veneer plywood with butt joints and matching perimeter wood trim. These walls contrast with the painted gypsum board partition walls, drawing attention to the circular walls.
- Rooms are typically pie-shaped and truncated at the rotunda.
- Partition walls in secondary spaces are smooth finished, painted (white) gypsum board.

Floors:
- Assumption that floors were vinyl asbestos or asphalt tile. This needs to be verified by further investigation.

Ceilings:
- Assumption that ceilings were painted gypsum board. This needs to be verified by further investigation.
- Lighting is recessed fluorescent.

Doors:

- Office Doors, flush birch veneer with clear finish

Second Floor

Walls:
- A central rotunda provides circulation to the winding stair, office, public restrooms, lobby, and Exhibit Shelter Upper Visitor Gallery to the north. As on the first floor, Rotunda walls are paneled with varnished natural finish veneer plywood with butt joints and perimeter matching wood trim. Again, these walls contrast with the painted gypsum board partition walls, drawing attention to the circular walls.
- Rooms are typically pie-shaped and truncated at the rotunda.
- Partition walls in secondary spaces are smooth finished, painted (white) gypsum board.

Floors:

- Restroom floors adjacent to closet are covered with turquoise mosaic grouted tiles laid in rectilinear courses without regard to the curvilinear nature of the floor plan.
- Assumption that floors were vinyl asbestos, asphalt tile, and concrete. This needs to be verified by further investigation.

Ceilings:

- Rotunda has a flush circular natural light skylight located at the exact center point of the Admin Wing.
- Assumption that ceilings were painted gypsum board. This needs to be verified by further investigation.
- Restroom ceilings are smooth glossy enamel on gypsum board with surface-mounted fluorescent light fixtures.

Doors:

- Flush birch veneer (natural finish) with paneled transom.

First and Second Floor Common Features:

- Walls that form the central rotunda are curvilinear.
- Partition walls radiate from the center point of the Admin Wing.
- Finish surfaces of both sides of the rotunda walls are glossy (natural) varnished birch veneer plywood, curved to match curvilinear geometry. Panels are butt-jointed vertically and horizontally.
- Doors are flush birch veneer doors (natural finish) with paneled transom above. Dutch doors are used in selected locations.
- Two flight, pie-shaped, winding stair with a mid-landing (hung from the second floor by two steel rods) that reflect the cylindrical shape of the exterior walls.
- Square section steel stair rails with painted steel (pink) balustrades, newels and hand rails.
- Stairs are open riser concrete treads.

<u>South Wing:</u>

- Exposed tapered steel I-beams (painted dark brown) at ceiling.
- Surface mounted electrical conduit and fluorescent lighting.
- Painted gypsum board walls.
- Painted exposed wood ceiling construction if verified during investigation.
- A furred out pipe chase runs along the base of the south wall in all rooms except the mechanical. Directly atop the pipe chase, wood bookshelves fill the space between it and hopper windows above in the Lab, Paleontologist's .office and Library.
- A long, narrow, windowless corridor provides primary circulation to the Library, Lab, and Staff Restroom, Paleontologist's office, and the Lobby.
- Offices, labs, library and mechanical spaces are long, rectangular, narrow spaces.
- Display windows in the Lab north wall to allow viewing from the Lower Visitor Gallery.

Exhibit Shelter

Curtain Walls:
- See previous discussion of curtain walls listed under exterior walls.
- Exposed structural steel columns and beams .painted dark brown.
- All mullions, muntins, and operable sash are steel painted pink.
- Mechanically linked gearing and linkages to operate ganged window sash (awning type) located in selected areas. Rods, pulleys, chains, and manual cranks are visible.

Ceiling:
- Exposed, equally spaced, tapered steel beams (painted dark brown).
- Exposed, equally spaced, steel purlins perpendicular to the primary beams (painted pink).
- Exposed wood roof decking planks running parallel to primary beams (painted pink).

Doors:
- See description of exterior doors under Exterior Features, Exhibit Shelter for doors on west elevation.
- Two sets of double leaf interior doors, located under the mezzanine, provide access to the west end of the South Wing. They are both double leaf wood flush doors (painted pink).
- Interior doors under Upper Visitor Gallery (east end) that access Lower Lobby are aluminum-framed glazed double leaf (unpainted).
- Interior doors on Upper Visitor Gallery (east end) that access Lower (202) Lobby are aluminum-framed glazed double leaf (unpainted).

Upper Visitor Gallery:
- Upper Visitor Gallery concrete deck is covered with reddish-brown, wall-to-wall low-pile carpet
- Underside: Exposed cantilevered steel beams (painted dark brown) with exposed metal deck pans (painted pink).
- Topside: Square section painted steel (painted pink) guardrails with (painted pink) wire mesh balustrade (painted pink).
- Painted, steel, all glazed partitions enclose Lobby vestibules 112 and 202 above and below the east end of the Upper Visitor Gallery.
- Polished aluminum or stainless steel speakers hang from the ceiling framing. They are round and globular in appearance.

Upper Visitor Gallery:
- Straight single flight.
- Concrete treads (natural color) with steel infill risers and stringers (painted dark brown).
- Stair rail and balustrade, square steel tubes (painted pink).

Partition Wall under Upper Visitor Gallery:
- Smooth gypsum board (painted pink) with regularly spaced steel columns (painted dark brown).

Lab Display Windows in Partition Wall under Upper Visitor Gallery:

- Fixed glass, regularly spaced, painted wood framed (borrowed light) windows.
- Three lights have been covered in, but it appears the original windows are still extant.

Glazed partitions beneath the east end of the Upper Visitor Gallery.

- Heavy rectangular steel (painted) section mullions and door frames form a partition around the Lower Lobby (112).
- See previous discussion of Lower Lobby aluminum doors.

Mobile Quarry Scaffold:

- Steel pipe guardrails of varying size with wire mesh in-fill (painted dark brown).
- Wood plank (unpainted) rectangular platform. Planks run perpendicular to the longitudinal axis.
- Ell shaped I-beam super structure that moves along a track on the north wall and one at the base of the quarry wall. Tracks run the full east-west length of the Exhibit Shelter.
- The scaffold platform suspends from the mobile superstructure. The platform is capable of traversing in a north-south direction as well as up and down.
- An electric hoist is located on each of the north-south tracks of the I-beam superstructure.

Exhibit Shelter Ground Floor:

- Guardrail defines the edge of the quarry demonstration area. The detailing is similar to that used for the guardrail on the mezzanine level with square section steel guardrails (painted pink) with wire mesh balustrade painted pink. Hinged gates are provided in selected location for access to Quarry display area.
- Wood frame (unpainted) Jack Hammer Rack at the east wall. Jack hammers and tools are stored there for exhibit purposes.
- Exposed compressor air pipe with jack hammer connection taps is located on the ground just north of the Lower Visitor Gallery floor slab. This pipe runs the full east-west length of the exhibit shelter.
- Embedded track for the Mobile Quarry Scaffold, visible in the exhibit area.
- Round glass electrical lighting fixtures surface mounted under the Upper Visitor Gallery deck.
- Speakers mounted under the Upper Visitor Gallery deck are similar to those described previously (polished aluminum or stainless steel units that hang from the ceiling framing above the Upper Visitor Gallery deck and flush mounted units on the ceiling over the Lower Visitor Gallery (They are round and globular in appearance). These appear original to the building, but this will have to be verified with further investigation.

Condition Assessments

Civil Condition Assessment

General

See Civil Site Plan C-1 for locations of the existing water, sewer, and drainage systems in the immediate vicinity of the building.

Water Supply System

Water for the visitor center and other development in the area was originally supplied from a 900 foot deep well located 500 feet north of the parking area which was pumped to a 50,000 gallon tank. However, the well water contained minerals which clogged and corroded plumbing and HVAC systems so in 1976 a new water main from the city of Jensen was extended to the area which now supplies all water with well only kept as backup.

The exhibit shelter was built above an existing 8-inch cast iron water line that runs along the base of the quarry wall and extends east of the structure. The line originates at the water tank located northwest across the valley and runs from the tanks down the hill beneath the road, up the quarry hill and through the flat area west of the building. The cast iron line from the tanks to the visitor center required constant repair, and was replaced with a 8-inch "Blue Brute" PVC line in 1999 according to park personnel.

The 8-inch cast iron water line that runs through the exhibit shelter was capped roughly 10-feet west of the structure and abandoned and a new 6-inch PVC line was installed running south through a new concrete vault (6-feet x 6-feet x 7-feet deep), then east on the south side of the south wing to a relocated fire hydrant (with hose box) south of the ramp. The vault contains a pressure reducing valve and gate valve. In July 2003 the vault was partially flooded due to a pipe leak.

From the vault a 4-inch schedule 40 PVC supply pipe encased in a flexible 6-inch ABS pipe is run into the building. Bill Dye reports this pipe is working well.

Water pipes in this vicinity are generally buried 8-feet deep without insulation, or at 6-feet deep with 2-inch thick Styrofoam board insulation above the pipe.

The building does not have its own water meter, but if the staff suspects there is a leak somewhere on a pipeline, they attach a portable water meter to a pipe to check for flow during periods of no water use. These pipes should be checked for leaks on a regular basis since there has been a history of water lines breaking due to ground movement at this site.

Sewage Collection System

Sewage from the building originally was collected by a 6-inch diameter vitrified clay pipe on the south side of the building and transported to a septic tank southeast of the parking lot and a dosing siphon/leachfield system near residence #46 in the residential area.

In 1976 a new sewage treatment plant was built east of the maintenance area at the base of the hill. The septic tank/leachfield system was then abandoned and sewage was piped to the new plant.

In 1991 the clay pipe was replaced with a new 6" PVC pipe line and three new manholes along the same route as the old pipeline. The pipe is about 5'-0" from the building in most places. Due to a history of ground movement at this site causing pipe breakages, the sewer pipes between manholes should be inspected periodically. These inspections could consist of visually looking for straight pipe between manholes, or better, running a video camera through the pipe.

The sewer pipes from the manholes to the building are double piped, with a 3-inch or 4-inch PVC pipe inside of a 6-inch PVC pipe. This was intended to prevent pipe breakage and aid in leak detection. Apparently it has worked well, and Bill Dye reports little trouble with these pipes now. The original pipes had failed and leaked due to ground movement.

The manholes have had some damage caused by ground movement and require repair. The lids and/or upper sections have been pushed to the side causing misalignment.

Drainage System

There are a series of storm drains on the roof of the building. They are currently all piped into the sanitary sewer system (see Mechanical section for details). Storm drains are not normally connected to a sanitary sewage system because it may overload the treatment system, but the park staff reports that the wastewater treatment plant is oversized to the point that the additional flows do not cause a problem.

Some of the older sets of plans show a French drain running under the service drive along the south side of the building. This was apparently an attempt to move shallow groundwater away from the building, but the park staff report that it has been abandoned and is no longer functioning. It became plugged with soil and efforts to clean it were not successful.

The ground around the building reportedly slopes away from the building well enough to prevent ponding during rainfall events, this should be confirmed by surveying the site. However, on the north side of the building, above the exhibit shelter, there are sink holes that water flows into when it rains. This situation may contribute to the raising of the groundwater level under the building which increases soil expansion.

Pavement

See the Landscape section of this report for an assessment of the pavement condition.

Site Condition Assessment

The following is a description of existing conditions

Climate

"The climate in the region affects development planning. Summer temperatures can be uncomfortable in unshaded areas of lower elevations. Snow fall is generally light, but accumulations cover the ground during most of the winter months."[35] Monument roads at higher elevations are generally closed during the winter months. Rainfall was reported to be less than 10 inches per year, but can occur in large amounts at one time in infrequent intervals.

Site Drainage and Soil Conditions

The soils in the Morrison Formation are composed of sedimentary layers with strata of greenish-gray and other colors in bands of red and purple. Named after the town of Morrison Colorado, the formation yielded the first discoveries of dinosaur fossils in North America. One hundred and fifty million years ago these dinosaur bones were buried by layers of mud, sand, and silt that settled on the floor of the inland sea that covered central North America. Through geologic time these materials formed rock layers thousands of feet thick that were then uplifted in the same geologic processes that created the Rocky Mountains. Over thousands of years, erosion exposed fossil bones within the Morrison Formation.

The formation's soils of sand, slit, clay, and weak sedimentary stone form colorful rainbow strata that often are categorized as thin crumbly mudstone, thin layers of mud, silt, sands and gravels of f ancient riverbeds and floodplains. The Morrison formation at Dinosaur Visitor Center is uplifted 65 degrees, exposing the sedimentary layers to the north. Here "the Uinta Mountains taper off into a series of small folds, one of them called Split Mountain because the Green River has cut a deep gorge directly through it. The Morrison Formation and other strata encircle the foot of Split Mountain in a series of narrow ridges and valleys."[36] One of these ridges is the site of the fossil quarry and the Quarry Visitor Center. "Since the Quarry site was on the top of a ridge cut by deep ravines at either end, it was convenient to dump the overburden down the ravines." [37] Overburden and spoil material accumulated in the ravine from 1909 to construction of the visitor center in 1956-58. When the current Visitor Center building opened in June 1958, the first visitors viewed few bones. Work in the quarry continued until the early 1980's and exposed an additional 1,600 bones.

The Quarry Visitor Center foundation, walks, and parking area were constructed on a combined base of Morrison formation soils and soil and rock debris removed by paleontologists as they exposed and removed dinosaur bones from the mountain. Initially, the hand-excavated debris was first removed by a bucket, then wheelbarrow, then by mule and dirt slip, then man powered small rail mine cart. Sometimes material was dynamited then bulldozed out of the way. During

[35] General Management Plan, 1988 page7, NPS/DSC
[36] Dinosaur The Dinosaur National Monument Quarry New Revised Edition, 2001, page 5
[37] Dinosaur The Dinosaur National Monument Quarry New Revised Edition, 2001, page 6

the first 50-years of quarry operations a very large amount of debris was simply dumped off the east slope.

Quarry Visitor Center

East side: This is the main visitor access to the Quarry Visitor Center. There are three doors on the east side; two visitor entry doors and one service vehicle access door. The finished (?) floor of the structure is elevated above the parking area, entry walk surface, and service drive. The walk and service drive drain away from the structure toward the parking area. The uneven and broken paved surfaces cause precipitation runoff to accumulate near the building foundation and penetrate the surface. Gravel surfaces to the east and south east and under the ramp may not slope sufficiently to drain runoff away from the building. The gravel surface may actually allow for the absorption of rainfall into the ground.

South side: On the south side of the structure there is a well compacted gravel driveway for maintenance and utility service. The high point elevation of the structure allows drainage to flow to the east and west. A three percent cross slope allows for good surface drainage away from the structure. The original concrete sidewalk adjacent to the structure has been removed in response to concerns that rainfall was accumulating and becoming trapped against the building. Had the exterior failed in the same way and direction as the interior concrete slab, rain runoff would have become trapped against the wall of the structure. This would have resulted in seepage along the expansion joint and moisture infiltrating the sub grade leading to foundation damage. A caulked line is visible on the block wall corresponding to the walk alignment, indicating previous attempts to prevent water seepage.

West side: The west side of the structure is where employees park their vehicles, and services and utilities access the structure. There is positive drainage away from the structure with a shallow 2% slope to the east and becoming greater, 3-4% further to the southeast.

North side; The ground elevation is above the interior exposed rock / fossil face. The surface grade undulates along the east – west foundation wall creating pockets for collection of rainfall. The slope away from the structure is very flat with no positive drainage away from the structure. Further away from the structure sink holes appear where rain runoff collects and travels down the rock strata possibly to the rock / fossil face and building foundation below.

Photos show undulations in grade along north foundation and sink holes some distance from the structure. See sheet EX21 photos B,C,E,F

<u>Drainage Structures</u>

Are all underground drainage systems functioning?

Downspout Drains: The structure has 6 interior downspout drains for the visitor gallery upper roof, connected together and draining into the sewer system inside the building. The administration wing lower roof has 5 downspouts which are connected to the sewer system by

PVC pipe. These were recently repaired and are currently functioning. No other exterior building drainage systems, foundation drains or French drains are known.

Site drains, drop inlets and French drains: These drains occur throughout the site. Inspections based on the 1956 as built drawings revealed that the drop inlet locations have been changed.

Drop Inlet No. 1: The as built drawings show one drop inlet at the south most end of the parking area. It was not found during the site inspections. It is possibly covered by asphalt pavement.

Abandoned CMP: An abandoned CMP 8" diameter no end section is located in the southeast corner of parking area. The fill slope evidence indicates that the CMP has not been used for some time. The inspection was unable to determine the pipe's condition beyond two feet from the end of the pipe.

Drop Inlet No. 2: A new drop inlet was recently installed in a developing low spot in the parking area. The surface grate measuring two feet wide by four feet long was placed on a concrete drop box with a galvanized 18 inch CMP pipe exit no end section.

Drop Inlet No. 3: This drop inlet was replaced recently and consists of a welded pipe grate in concrete over a shallow concrete box.

Junction Box: Drop inlet no.3 is connected to the junction box with an n 8" pipe. The as built drawing indicates vitreous clay pipe, but inspections have not confirmed this. The junction box is covered with a steel cover bolted closed. The as built drawing indicates a 12"drain to the south and 90 feet to the outlet which was not visible from above.

Septic Tank/ Replaced by Manhole: The septic tank for this sewer line has been replaced with a manhole. The line connects to the sewage treatment plant and spray field downhill.

French Drain to Drop Inlet: This French drain, located at the lower 1/3 of the concrete pedestrian ramp, services the upper level ramp and access to the quarry building. There is an iron grate on an iron collection box with an iron pipe exiting the bottom of the box. Collected runoff drops 2-3 feet to a grated 2'x 2'drop inlet. It is unknown where this drop inlet drains.

Drop Inlet No. 4: This inlet is located at the far west end of the service area as shown on the as built drawing. This drop inlet was damaged by grading and re-grading during the removal of debris that had fallen from the hillside to the south. The grate over the concrete collection box remains tilted and the collection box itself has sustained extensive damage. The as built drawing indicates that a 12" pipe exits 130' below on the fill slope, although constant re-grading of the site has covered over the exit of this pipe.

Vehicle Circulation and Parking

What is the condition of site roads, parking and vehicle site accessories? (signs, paint stripe, wheel stops, curbs etc.)

Parking Area
Photographs of the completion of the Quarry Visitor Center show the construction of concrete walks from the pedestrian ramp stairs to the lower level door. Two photographs reveal that prior to the placement of asphalt the parking area near the Visitor Center utilized concrete curbs and gutters. One photograph looking south shows that a center parking island utilized concrete curb and gutter. Within the historic zone of 100 feet from the building foundation, the concrete walk, curb and gutter should be replaced.

Existing Parking area: This asphalt surface is surrounded by a wood curb and three rows of paint-striped parking. Two rows of angle parking form a center island that provides parking for 12 cars and 2 accessible parking spaces. The eastern-most row of angle parking, measuring 130', provides space for an additional 13 cars. The parking area is sized for 25 20' x 10' parking stalls and 13' x 10' accessible parking stalls. Paint stripes have weathered away, making it impossible to count the exact number of parking stalls.

The as built drawings show a high point elevation near the entry to the parking area and a low point elevation with a drop inlet at the south end of the parking area. Inspection reveals that this drop inlet does not exist. It either was never installed, removed at a later time, or sealed by asphalt.

Drainage now flows from the high-point elevation at the entry and high elevations along the west side curb across to the east side and from the south end north and east to a newly installed drop inlet (Drop Inlet no. 2). The inspection revealed that the east side of the parking area is settling unevenly, resulting in a lower elevation. The new drop inlet was installed to provide drainage for the altered elevation.

The asphalt is uneven and cracked. Cracks have been patched with crack sealer but at various locations the cracks are opening. In several locations the asphalt surface is uneven, a result of subsurface distress. Rutting has occurred in the bus stop where heavy vehicle traffic has displaced the asphalt surface.

Timber curbing: Timber curbing is 6 x 6 pressure-treated lumber. The timber curbing is jointed and bolted together prior to the last asphalt application. The wood curbing to the west is painted red over yellow along the front of the visitor center to indicate where parking is not allowed. The remaining curbing is incised, pressure treated and unpainted. The curbing shows extreme wear and weathering and is need of complete replacement. Curbing at the transit, tram, or bus stop shows signs of excessive wear. The timber curbing has been installed since the original construction. It is unknown whether the concrete walks and curbs were removed or covered over.

Timber guard rail: The vehicle guide rail does not meet Federal Highway Administration (FHWA) standards. The 8 x 8 creosote timber posts with 3 x 8 creosote rails have no steel backing plate. The timber guard rails are used on the down slope side of the parking area and access road. Replacement will require meeting FHWA railing design and evaluation for upgrading to a crashworthy structure.

Center Island: The center island, including all site furniture and utilities, has been removed. The

center island has been replaced by fading paint stripes to identify parking stalls. *The center island is mostly outside the 100 feet of the historic structure zone.* (Has it been removed?)

Asphalt: The Federal Highways Land Administration has determined that the asphalt is in poor condition due to cracking, rutting, and irregularities resulting from subsurface distress.

Pavement joints: Cracks in the asphalt pavement have been sealed with crack sealer.

Pavement markings: Pavement markings for car parking are not completely visible. Stripes mark parking for a 19 car and 2 handicap vehicle center island. Although markings on the east side of parking area are not visible for counting, measurements indicate possible parking for 13 additional vehicles. The mass transit bus stop has no pavement makings other than the painted timber curb.

Asphalt curbing: Asphalt curbing was installed along the west side of the entry road. Inspections of the asphalt curb revealed damage such as marks and chipping from snow removal equipment as well as additional wear from other vehicle impacts. The asphalt curb is in poor condition and should be replaced.

Concrete curbing: The historic photographs show the parking area with concrete curb and gutter including the center island which was removed to improve traffic circulation and accommodate larger vehicles.

Service Area and Drive: Access to the service area and west side of the Quarry building begins at the southwest end of the parking area. The wood curb has been covered with asphalt. The drive crosses the asphalt walk and an asphalt apron. The driveway follows the south wall of the administration wing to the west, narrowing at the southwest corner of the building. The driveway is 16 feet wide and surfaced with compacted pea gravel. The driveway alignment curves slightly to the north and then continues west to the end of the talus slope. Drainage is across the driveway to the south where a swale east and west carries rain runoff to drop inlets. A concrete walk along the south exterior wall of the administration wing was removed. There is no visitor access. The driveway can be closed by a chain gate which is hooked in an eye bolt on the wall of the concrete ramp and across to a post south side of the driveway.

Loose material, dirt and rock fall to the service driveway from the eroding south hillside. Park maintenance bulldozes the debris to the west and over the talus slope.

Pedestrian Access

What is the condition of pedestrian circulation walks, trails, and guard railing?

Employee Entry

West service doors: These doors have concrete slabs at the sills that have been recently replaced.

Visitor Entry

Visitor Walks: Color pigment specification and score joints shown on the as built drawings of 1956 indicate that the primary walk around the parking area to the lower entry door of the quarry building was colored concrete. The concrete walk has been removed, replaced, or covered over with an asphalt surface.

Entry walk: The asphalt of this walk at the lower doorway is both settling and heaving and has separated from the door sill. A rubber mat covers the sidewalk at the entry to eliminate a safety tripping hazard caused by the uneven surfaces. The entire entry walk has numerous patches and the cracking asphalt has been sealed with crack filler. See sheet EX03 photos C,D,E.

Walk around the parking area: This asphalt surface also has settled, causing cracking that has been caulked with sealer. The walk has been patched after being disturbed by various utility service repairs. It was not determined as to whether a concrete walk was installed and covered over with asphalt.

Stairs: Four colored concrete stairs that were once located at the lower end of the pedestrian access ramp have been removed or covered over with asphalt.

Colored concrete: Approximately 20sf of flat colored concrete remain where the top of the stairs once connected to the concrete ramp. The colored concrete stairs and walk once were parallel to the south and west side of the parking. The concrete walks and stairs can be identified in historic photographs. Today the walks are not visible and may have been removed or covered over with asphalt.

Access ramp: The ramp consists of exposed aggregate concrete walls, a concrete walk surface, and aluminum handrail. The ramp does not meet ADA accessibility requirements. A new ramp that meets current codes and regulations would not be in keeping with the historic character of the visitor center.

Pedestrian Guide Rails and Interpretation Signs: The pedestrian railing is a 2 x 6 top rail sloped at about 30 degrees mounted on 2 x 2 tubular steel frame above a 2 x 6 kick plate. The entire structure is painted NPS brown. At several locations the railing has moved as a result of subsurface disturbance. The kick plate boards are showing aging and displacement. Bolt holes are weathering and enlarging and will soon no longer hold. The pedestrian guard rail was constructed near south end of the parking area and front of the dinosaur statue. The guide rail is indicated on the as built drawing of 1956. See sheet EX02 EX) 3 and photos A, A, B, C.

.**Site Furniture**

What is the condition of the wheel stops, flagpole, benches, trash receptacles, and other site furniture?

Benches: The benches are located near the entry and south end of the parking area. They are representative Mission 66 wood slat benches, originally 8 feet in length by 21+/- inches in width.

The benches are painted NPS brown and have become sun bleached and weathered. Wood members have aged very well and with cleaning and repainting the benches could be reused, but would be better if replaced.

Upon inspection it was found that no two benches are the same length; they vary in length from 5 to 8 feet. It appears that, as in other parks with this style of bench, when the ends of the benches became damaged by wear, weather, and abuse, the end of the bench was end cut off and the legs either replace or adjusted to re-center the bench top. Excellent repair work has been performed by park maintenance given the condition of the existing benches.

It was determined that the site furniture does not alter the visual aspect of the historic architecture or landscape. Nor when site furniture is removed has it any affect on the visual aspect of the historic architecture. Therefore a determination as to a style bench to replace these should be made by the park. ***I'm not sure I follow this.***

New benches: The new park benches are made from recycled plastic with formed bench seat and legs and a back rest. The benches are 6 feet in length. The benches are tan colored seat and back with black colored frame and legs. The new benches are located near the lower entry door.

Trash receptacles: These are constructed of exposed aggregate sides and a removable plastic hip roof with square center opening. The lid can be completely removed for servicing. Each receptacle is labeled to identify function (trash) with a metal sign bolted to one side. Size 22" square 3' high.

Recycle cans: The recycling cans are the same style but somewhat larger than the trash receptacles. They measure 28 ½" x 24"x 3' high. The metal recycling signs do not specify the type of material to be recycled.

Trash can combination ash tray: These trays are 12" diameter 20"+/- black and stainless steel ash trays with side mount trash containers. This is a portable piece of site furniture supplied by the park. The ash tray(s) are located near the front door and under the ramp ***near the?*** with four benches.

Signs: The signs are wood with routed white letters on dark brown background. These have changed throughout the years, but remain the same in style, and reflect the same messages. ***If the style and messages are the same, what's changed?***

Flagpole: Flagpoles are required at all government facilities. The flagpole is approximately 21 feet tall. The overall condition of the flagpole is good; it shows some signs age such as oxidation on the aluminum, a small dent in the base plate, and rope wear on the aluminum pole itself.

Statuary: The statue of the stegosaurus presented by Sinclair Oil Company has weathered well.

Site Utilities

Are utilities as shown? What changes? And what is the condition of the utility? If possible note.

New propane tank: A 12,000 gal tank propane tank has recently been installed in the west portion of the service area. A 10 foot chain link fence surrounds the propane tank.

Waterline: The waterline carries water across the small valley northwest of the site. The waterline crosses the entry road west of the site, ascends the west talus hillside, crosses the service drive west to east and enters the west side of the building.

Sewer lines Sewer lines access various parts of the building. The sewer lines are approximately 10' out from the south wall of the administration wing and 3-4 feet under the service drive. The sewer lines are routed east to the south end of the parking area, and then downhill (south) to the sewage treatment plant in the maintenance area.

Telephone service: Telephone service is routed up the west talus slope, then along the south side of the service drive to a pedestal 138 feet from the west wall of the building. Telephone service is supplied to the west side of the building.

Electric service: Early photographs show aerial power lines coming from the west and to the service area of the Visitor Center. Overhead wires have since been removed. An underground electric service line enters the site from the northwest and connects to a transformer north of the compressor building. From the transformer the electric service line is routed southeast to a meter located near the southeast corner of the compressor building, then east to the west end of the building.

Air line: The air line was added after the completion of the building for use in fossil quarrying. The compressor building may have been built of the sheet metal materials from the previous structure. The air line is routed above ground to the west side of the gallery to service the air tools used on the rock face. The air line, compressor building, and old powder house (Douglas office) are strong historic elements but are unknown to the visitors. The air line, tools used, crane and track are important in the history of the fossil quarry.

Bollards: Two wooden bollards protect the compressor building from vehicle damage.

Bollards: Two metal pipe bollards with welded frame and diamond mesh painted yellow are used to protect the HVAC system on the south wall of the administration wing from vehicle damage.

Site Cover

What is the condition of the site cover? Landscape materials, irrigation systems etc.

Vegetation: This desert environment is dominated by slow growing desert shrubs, sage brush and greasewood requiring no maintenance. Landscaped areas, planting beds, mowed areas, grounds of special attention, irrigation systems etc. do not exist. Occasional trimming or removal of a shrub is required when the shrub might damage vehicles or disrupt pedestrian traffic.

Cover Gravel: This gravel is similar to pea gravel, one-inch and less in size. This cover is used from the front entry of the building to the south, under the pedestrian access ramp, and south and west to the service drive around the administration wing. The cover gravel continues to the service drive, west along the south wall of the administration building, west throughout the service area. The material closely represents the natural ground surface and blends well when viewed by visitors.

Summary and Recommendations

Would the removal of the site furniture have any visual affect on the appearance of the historic architecture? The structure is unique, as noted that way in the NHL nomination form. The nomination form further identifies a distance of 100 feet from the foundation in all directions as the historic zone. Therefore, the park must determine any significance for site furniture listed and or shown in photographs during the early history of the structure.

Documented history shows catastrophic water events have seriously damaged the structure. As repairs, demolition, reconstruction, and redefinition of interior functions progresses, there is an opportunity to remove restroom facilities from the structure and therefore any future catastrophic water events.
A soils engineer needs to provide a design for structural support soils before new construction by bridging the poor quality of the talus slope. A complete soils report and engineering recommendations are to be strictly followed. Surface drainage must be away from the structure. Surfacing materials should be designed to further reinforce and assist in bridging poor soils should settlement occur.

The concrete walks and stairs as per1956 drawings should be reconstructed. ADA requirements will be met inside the structure.

Based on the recommendation that the administration wing, library/lab/utility wing is to be demolished and the structure be replaced with similar construction.

- Remove any and all nearby utilities associated with water, including water supply, sewer, and storm sewer. Route utility services via the shortest distance to the structure. Construct a new shuttle stop with shade structure and restroom away from the historic structure. This eliminates the potential for future catastrophes involving water within and nearby the historic structure. A new restrooms/bus stop facilities could be built to the south of the existing parking area and possibly south of the service drive.

- Recommendation for grading is that all excavations be backfilled with suitable material and compacted in 6” lifts around the structure. The soils report and soil engineer’s recommendations indicate that other disturbed areas of the site should have not less than 3 feet and an optimum 5 feet below finish grade removed and replaced with suitable backfill compacted in 6” lifts with new finish surfaces applied.

- Recommendation for the north side of the gallery structure is to seal off any further surface rain penetration to the rock strata below. It is the declination of the existing rock strata which is carrying moisture to the structure foundation below. Application of a waterproof membrane to collect rainfall, sloping away from the structure, to be collected and removed from the site as far from the foundation as possible.

- Need to study and establish new circulation patterns for the types of vehicles using parking area. Large recreation vehicles and tour buses require a different pavement design than do automobiles. Tram and shuttle buses traveling the same route can cause rutting in asphalt that requires a concrete wear surface at the bus stop. *This project is soon to be undertaken by Federal Highways Administration with 30% complete construction drawings November, 2003 and construction in 2004.*

- The parking area should be completely replaced. The complete removal of the talus slope and replacing all quarry waste with compaction is cost prohibitive. The soils report and the soil engineer's recommendations indicate that the parking area should be reconstructed. At a minimum; remove the top 3 feet of surface material, replace with quality fill, place structural geotextile fabrics compact in 6 inch lifts to bridge poor underlying soils. Replace surface with 3" quality asphalt. Remove timber curb and replace with concrete curb and gutter. Repaint parking stripes and crosswalk. *Warning this is only a temporary fix, with a life cycle not to exceed the length of time of the surface material. The life cycle will be shortened subject any catastrophic event.*

- Remove timber curb and asphalt and construct a concrete apron integrated with the concrete walk for service drive. Replace timber curb with concrete curb and gutter.

- Construct 3' high concrete retaining wall to control material eroding from the south hillside. Remove debris and additional hillside from behind wall to minimize maintenance and to allow equipment to remove material from behind wall. South service drive is to be regraded with high point on the south wall sloping in east, west and south directions not less than 3% from the administration wing. Hard surface service drive would prevent rain penetration into soils below. Material should be removed from the site or dumped off the west slope. *Warning the west slope being a talus slope will **not** support new construction on top.*

- West slope drainage should be reestablished with swale or continuous piping to remove drainage from site. Care is needed to prevent damage or blockage of piping or swale. Should the current practice of removing excess debris by grading and dumping off west slope continue, it should be noted that this slope can not support future construction. Construction would result in the same failures as those seen on the east slope.

- Employee parking for 3 to 5 vehicles can be established near the service entry. Removing vehicles from and allowing additional visitor parking in the visitor parking area. ***I'm not sure what this should say.***

- Site furniture should be pleasant, durable, and low maintenance. The materials used to construct the site furniture must be able to withstand extreme environmental conditions and heavy use. Within the 100 ft historic zone, the park should determine as to whether site furniture is to be part of historic scene; the existing site furniture can be replaced with the same wood bench products. However, new materials such as plastic will hold up better to the harsh environmental conditions and can be used to replace items like lumber while retaining similar characteristics.

- Numerous flag poles have been removed for maintenance and cleaning. This can be done to restore the luster to the existing flag pole or perform other maintenance procedures i.e. replace rope, pulley, or lube working parts, polish and clean.

- The pedestrian guard rail could be restored in place. Adjustment to level the top surface, repair and replace lumber and hardware, and repaint. Weld 2 x2 tubular steel and repaint. Plastic wood (trex) may replace lumber.

- The pedestrian guard rail near the lower entry can be restored in place.

- The amount of expansion for development is subject to surface area available. Expansion of the parking area by terracing the parking bays provides marginal expansion and presents the same problems of structural support provided by soils under the facilities.

West, Linda and Cure, Dan
2001 Dinosaur The Dinosaur National Monument, Published by Dinosaur Nature Association, 1291 East Highway 40, Vernal, Utah 84078-2830 www.doinsaurnature.com

An adequate survey with spot elevations near the doors is needed to establish future good drainage.

It is possible to have the flagpole cleaned and polished with the base plate replaced.

ITEM	COMPONENT	INVENTORY and ASSESSMENT
QUARRY VISITOR CENTER ARCHITECTURAL EXTERIOR INVESTIGATION		
1.	EXHIBIT SHELTER ROOF	• Membrane roof in ten foot wide rolls concealed anchors and a few miscellaneous bubbles • Painted an off white color, 12% paint damage, peeled, scraped • Roofing raveled at patches • Expansion joint in good condition • Six roof drains operational • Overall good condition
2.	ADMINISTRATION ROOF	• Membrane roof, concealed anchors • Painted an off white color, poor condition. • No cant strip at parapet wall to roof transition. Membrane split and patched. • No cant strip at skylight to roof transition. Membrane split and patched. • Patches on membrane roof are failing in a number of places. • Skylight interior plywood drum finish is warped, peeled, and has failed. • Three roof drains seem operational. • Membrane finish at top of 3 foot high parapet at Exhibit Shelter has failed. • Overall poor condition.
3.	SOUTH WING ROOF	• Membrane roof, concealed anchors. • Some miscellaneous bubbles. • Painted an off white color, good condition. • Roofing penetrations seem flashed well. • Expansion joint in good condition. • Equipment on roof sits on rubber pads, and is not fastened down to roof structure. • Metal roof gutter is mounted below the roof fascia edge.
4.	EXHIBIT SHELTER EXTERIOR NORTH WALL	• Water stands against above grade concrete foundation wall. • Concrete foundation wall has a number of hairline cracks. • Steel window wall is in good condition with some peeling paint. • Window glass panes are in good condition. A few with different tinting from majority. • Operable windows east of the building expansion joint do not open.

ITEM	COMPONENT	INVENTORY and ASSESSMENT
		• Operable windows west of the expansion joint open with hand assistance. • Roof soffit boards are in good condition. One split board.
5.	EXHIBIT SHELTER EXTERIOR EAST WALL	• Concrete foundation wall is cracked and in poor condition. • Historic metal doors replaced by wood frame wall and plywood finish. • Steel window wall is out of square and pulled up from concrete foundation wall. • Steel window wall is in poor condition. • Four window glass panes are cracked. Otherwise windows are in good condition. • Two plexi-glass panes are warped and have separated from the steel frame. • Roof soffit boards are in good condition.
6.	EXHIBIT SHELTER EXTERIOR SOUTH WALL	• Steel window wall is in good condition. • Wood frame lower wall with roof membrane finish is in good condition at South wing. • Wood frame lower wall with roof membrane finish is in poor condition at Administration wing. • Window glass panes are cracked in many places. (40 cracked panes) • Applied sun shade safety film to window glass panes is failing. (3 panes) • Window plexi-glass panes are pulling away from frames. (3 panes) • All operable windows, except a bank of 4 at the west end, do not open. • Roof soffit boards are in good condition.
7.	EXHIBIT SHELTER EXTERIOR WEST WALL	• Stone/mortar drain surface adjacent to foundation wall is cracked . • Some of concrete foundation wall is below grade. Not investigated like number 10. • Concrete foundation wall and piers above grade are in good condition with a few cracks. • Concrete masonry unit wall is in poor condition. Units are cracked, broken, and displaced. • Steel window wall is pulled up from the concrete foundation wall and is cracked. • Masonite window/door panel is in poor condition with damaged hardware. • Window glass panes are cracked. (2) • Metal double doors are jambed, dented, and in poor

ITEM	COMPONENT	INVENTORY and ASSESSMENT
		condition. Hardware is loose and broken. • Roof soffit boards are in good condition. One split board.
8.	SOUTH WING EXTERIOR WEST WALL	• Concrete foundation wall is below grade. Not investigated. • Concrete masonry unit wall is in poor condition. Units are cracked, broken, and displaced. • Historic double doors replaced with single door and wood frame infill. • Wood frame plywood finish paint is cracked and peeled. • Metal roof fascia hides corrections to roof drainage and south wing movement.
9.	SOUTH WING EXTERIOR SOUTH WALL	• Concrete foundation wall is cracked and in poor condition. • Concrete masonry unit wall is in poor condition. Units are cracked, broken, and displaced. • Steel hopper window units will not open and are in poor condition. • Metal gutters and downspouts are in fair condition. • Roof soffit and overhang soffit are in fair condition.
10.	ADMINISTRATION WING CIRCULAR EXTERIOR WALL	• Concrete foundation wall is below grade. Not investigated. • Concrete masonry unit wall is in poor condition. Units are cracked and broken. • Concrete infill panels are in poor condition. Units are cracked and spalled. • Concrete infill panel pipe holes filled or patched. • One 2-foot metal fascia section at roof edge damaged and paint is peeling on others. • Most operable steel casement windows are inoperable. • A number of steel fixed and casement windows are pulled away from the concrete wall panel. • One broken window pane is evident. • Historic air conditioner louvers have been covered with plywood or metal panels. • Three swamp coolers have been added to the façade on the first and second floor levels. • A swamp cooler water line is attached to the façade. • One swamp cooler leaks water next to the building foundation. • Miscellaneous bolts, water pipe, and electrical junction box are attached to the façade. • Steel window wall separated from CMU wall at east

ITEM	COMPONENT	INVENTORY and ASSESSMENT
		side of the building. • See interior doors for entrance conditions.
11.	RAMP	• The ramp does not meet ADA accessorily requirements because it is too steep and too long. • The ramp's north end is supported with steel columns and a beam which are not historical, and are visible to visitors. • The ramp's north end is offset from the 2nd floor doors both horizontally and vertically. • Pier 1 (northern most) is cracked at the top. • Numerous cracks appear in the vertical ramp walls. • Pier 3 is pulled away from the concrete ramp and the ramp is supported here by steel beams, jacks, and timber cribbing hidden by plywood panels. The soil is caving into a large hole on the west side of this construction. • Pier 4 (southern most) is not sand blasted as are the other three, and is not shown on the historic drawings. • The ramp walking surface is cracked at piers 1, 2, 3, and 4. • Concrete ramp to bituminous surface at bottom of ramp is cracked both vertically and horizontally. • The metal hand rail is loose at the ramp bottom on the western side. • The metal hand rail is loose near pier 2 on the eastern side.
QUARRY VISITOR CENTER ARCHITECTURAL INTERIOR INVESTIGATION		
CORRIDOR (GROUND FLOOR) RM 105		
1.	Ceiling	• Gypsum board, Electrical Conduit, Fluorescent Lights • Ceiling hatch at east end • Ceiling crack near corridor center runs from wall to wall. • Cove molding
2.	South Wall	• Gypsum board- raised joints, waves, bowed panels • Corridor out of square in the transverse direction, a parallelogram • Gypsum board split and pulled away from wall at corridor west end • Original door to Geologist has been filled in. • Expansion joint vertical trim 5 feet from west wall • 1x4 base
3.	West Wall	• Gypsum board • Out of square door frame

ITEM	COMPONENT	INVENTORY and ASSESSMENT
		• Door and jamb in poor condition. • Hardware jury rigged to accommodate moving wall and floor. • Door has door closer and magnetic hold open.
4.	North Wall	• Gypsum board- waves and bowed panels • Expansion joint vertical trim 5' from west wall (no trim on ceiling). • Electric panel and fire alarm panel at east end of Corridor.
5.	East Wall	• Dutch door, birch finish, transom panel, poor condition, racked frame. • Door hardware jury rigged to accommodate moving wall and floor. • Door has door closer and magnetic hold open.
6.	Floor	• Concrete floor slab tilted down toward the north. • Slab ripple runs from north to south across corridor near column line 6. • Carpet
LIBRARY/CONFERENCE ROOM (GROUND FLOOR) RM 111		
7.	Ceiling	• Gypsum board, no cracks. Ceiling Fan, Fluorescent Lights, Electrical Conduit • Exposed steel beam structure • Exposed piping for Halon protection system
8.	South Wall	• Gypsum board finish • 1 ½ inch exposed computer conduit • 1x4 wood base all around room • Window interior shutters held up by 2x2 supports on shelves, shutters not operable • Six steel hopper type windows with wood trim, 4 non-operational • One window removed and replaced with an air conditioner • Window hardware in poor condition • Window screens in poor to fair condition • Window frames displace both vertically and horizontally (1/2 inch max) • Window AC jury rigged into window opening • One window open (won't close) • CMU piers cracked on exterior at some windows • Built-in wood book shelves above built-in wood frame pipe chase
9.	West Wall	• Gypsum board-large cracks, joints, and waves • Wood studs in walls assumed to be damaged

ITEM	COMPONENT	INVENTORY and ASSESSMENT
		• Pipes and conduit exposed as on all walls • Steel beam exposed near ceiling by design
10.	North Wall	• Gypsum board-cracks at beams, joints raised, panels bowed • Wood studs in walls assumed to be damaged • Free standing Halon tank next to door and controls on wall • Door shaved at bottom, poor condition • Hardware jury rigged to accommodate moving wall and floor • Door has door closer and magnetic hold open
11.	East Wall	• Gypsum board/plywood panel, exposed screw heads • Electrical wall mounted control panel with 1 ½ inch exposed orange computer conduit behind free standing electronics cabinet • Built-in shelves and counter approximately one half the wall length
12.	Floor	• Concrete floor slab tilted down toward the north • Slab crack runs from east to west approximately 24 inches in from south exterior wall • Carpet worn and frayed
(former GEOLOGIST & DARK ROOM) PALEONTOLOGIST OFFICE (GROUND FLOOR) RM 110		
13.	Ceiling	• Gypsum Board, no cracks. Fluorescent Lights, Electrical Conduit • Exposed sheet metal duct at west end of room • Exposed steel beam structure with welded bolts used to anchor deleted original wall • Exposed piping for Halon protection system
14.	South Wall	• Gypsum board finish, patched • 1-1/2” exposed orange computer conduit • Four steel hopper type windows with wood trim, non-operational • One window removed and replaced with an air conditioner • Window hardware in poor condition • Window screens in fair condition • Two of four window frames displaced both vertically and horizontally (1/4” max) • Built-in wood book shelves over built-in wood frame pipe chase • Original dark room sink and counter removed

ITEM	COMPONENT	INVENTORY and ASSESSMENT
		• 1x4 wood base all around room
15.	West Wall	• Original west wall and 1x4 base removed • Gypsum board-large crack • Wood studs in walls assumed to be damaged • Furred out (4") partial wall • Steel beam exposed near ceiling by design • Built-in 36" deep counter with shelves above • Original wing wall at end of counter removed
16.	North Wall	• Gypsum board-cracks, patched, exposed conduit • Wood studs in walls assumed to be damaged • Partial wall built-in counter with shelves above • Electric panel near door • Original door to corridor from geologist deleted • Existing door jamb moves and door won't close (dated 6-14-91) • Door shaved at bottom, poor condition • Door has door closer and magnetic hold open • Hardware jury rigged to accommodate moving wall and floor, poor condition
17.	East Wall	• Gypsum board cracked and patched • Built-in shelves and counter
18.	Floor	• Concrete floor slab cracked and tilted down toward the north • Built-up temporary wood platforms under desk to ameliorate slab tilt • Carpet worn and frayed and covers only east part of the floor • Ghost of removed Dark Room wall visible • Composition tile flooring patch at west end of floor (very poor condition) • Differential slab elevations at construction joint at deleted wall location • Concrete mechanical chase below floor with plywood cover and hatch at west end of room
JANITOR'S CLOSET (GROUND FLOOR) RM 108		
19.	Ceiling	• No suspended ceiling (Exposed wood deck) • No lights
20.	South Wall	• Gypsum board and 1x4 base • Pipe cleanout 12" AFF and shelving above 5' • Halon tank on floor and original service sink removed
21.	West Wall	• Gypsum board cracked • 1x4 base
22.	North Wall	• No gypsum board-wood studs exposed

ITEM	COMPONENT	INVENTORY and ASSESSMENT
		• No base • Exposed conduit • Door jamb or wall is warped • Door is in poor condition • Hardware is in fair condition
23.	East Wall	• One half wall is gypsum board & one half is studs • No base • Electric panel
24.	Floor	• Concrete floor slab tilted down toward the north
(STAFF TOILET) VESTIBULE (GROUND FLOOR) RM 106		
25.	Ceiling	• Gypsum board, Fluorescent Lights
26.	South Wall	• Gypsum board-partial wall plus header at opening to Employee Locker • Original wing wall at Employee Locker has been deleted
27.	West Wall	• Plywood wall is furred out from original stud wall • 1x4 base
28.	North Wall	• Plywood cracked at all edges • Door frame racked • Door won't stay open • Door and hardware in poor condition
29.	East Wall	• Gypsum board cracked at corners
30.	Floor	• Concrete floor slab tilted down toward the interior quarry wall of building • Linoleum finish poor condition
(EMPLOYEE LOCKERS) STAFF TOILET (GROUND FLOOR) RM 107		
31.	Ceiling	• Gypsum board, Fluorescent Lights motion controlled • Exposed piping for wet pipe protection system
32.	South Wall	• Gypsum board cracked • Built-in wood frame pipe chase • Two steel hopper type windows with wood trim, non-operational • Window frames displaced both vertically and horizontally (1" max) • Window hardware in poor condition • Window screens in poor condition • 1 ½ inch exposed orange computer conduit • Grab bar
33.	West Wall	• Plywood and gypsum board wall • Five metal lockers
34.	North Wall	• Gypsum board cracked and rippled • Access panel above opening to vestibule
35.	East Wall	• Gypsum board cracked and rippled

ITEM	COMPONENT	INVENTORY and ASSESSMENT
		• 3'x3'x6' high shower stall with wing wall • Lavatory, water closet, grab bar, electric hand dryer, mirror • Original toilet partitions w/door have been removed
36.	Floor	• Concrete floor slab tilted down toward the north • Linoleum finish with turned up base in poor condition
PREPARATION LAB (GROUND FLOOR) RM 104		
37.	Ceiling	• Gypsum Board, Fluorescent Lights, Electrical Conduit, Pipes • Exposed sheet metal mechanical ducts at various locations in room • Six inch flexible mechanical exhaust pipes drop down from ducts. • Exposed steel beam structure • Forge exhaust fan suspended from beam in southwest corner • Exposed piping for wet pipe protection system
38.	South Wall	• Gypsum board finish, patched • 1-1/2" exposed orange computer conduit • Ten steel hopper type windows with wood trim, non-operational • One window removed and replaced with a duct • One window removed and replaced with a grille • Window hardware in poor condition • Window screens in poor to good condition. • Window frames displaced both vertically and horizontally (1" max) • Built-in wood storage shelves over built-in wood frame pipe chase • Exposed compressed air pipe installed above pipe chase • 5 foot base cabinet, counter, and metal sink with eye-wash at west end of room
39.	West Wall	• Gypsum board-cracked and rippled • Wood studs in walls assumed to be damaged • 1x4 Base • Door frame racked and door hard to latch • Door is in poor condition • Door has door closer and magnetic hold open • Hardware is in fair condition • Fume hood and exhaust pipe to outside located near south wall
40.	North Wall	• Gypsum board-cracks, rippled, exposed conduit • Wood studs in walls assumed to be damaged

ITEM	COMPONENT	INVENTORY and ASSESSMENT
		• Electric panel near door to Lower Visitor Gallery • Existing door jamb racked and door jammed at head • Door is in poor condition • Door has 2 door closers and magnetic hold open • Door closers are broken • Door hardware in fair condition • Three original windows to Exhibit Shelter covered with gypsum wall board
41.	East Wall	• Gypsum board • Built-in upper shelves • Built-in fire hose alcove near door • Door, see Corridor, Room 105
42.	Floor	• Concrete floor slab cracked and tilted down toward interior quarry wall of building • Slab cracked longitudinally 18” from south wall • Slab hairline cracked transversely
MECHANICAL EQUIPMENT (GROUND FLOOR) RM 103		
43.	Ceiling	• Gypsum Board, Fluorescent Lights, Electrical Conduit, Mechanical Pipes • Steel beam structure wrapped in gypsum board • Exposed piping for wet pipe protection system
44.	South Wall	• CMU on concrete foundation/stem wall up 36” AFF • Vertical crack 4’ from west wall – can see through crack to outside • Three other vertical hairline wall cracks • Boarded up vent hole to outside at east end, top of wall, plywood panel on exterior • Water service, Hot water heater, Service sink, and Boilers, all adjacent to wall
45.	West Wall	• CMU on concrete foundation/stem wall • CMU wall cracked horizontally and vertically both at corners & field-can see through crack, near boilers, to outside • Original oversized door frame racked • Existing single door replaces double original metal doors within the same frame (there is wood frame infill between double frame and single door) • Metal door in fair condition, binds, painted • Hardware in fair condition • Door has a door closer and emergency exit bar • Mechanical pipes on wall
46.	North Wall	• Gypsum board-rippled, exposed conduit and pipes • 1x4 Partial base

ITEM	COMPONENT	INVENTORY and ASSESSMENT
		• Main power cabinets and switches adjacent to wall
47.	East Wall	• Gypsum board/plywood rippled and cracked • Telephone and computer panels attached to wall (origin of 1 ½ inch orange computer conduit) • Telephone and computer cabinets adjacent to wall
48.	Floor	• Concrete floor slab cracked and tilted down toward the north • Concrete floor cuts with newer concrete visible • Centered 12”x44” floor drain • Metal cover 21”x37” access to mechanical chase under floor near service sink
(former TOOLS) LUNCHROOM/KITCHEN (GROUND FLOOR) RM 101		
49.	Ceiling	• Metal deck and Steel beams, Gypsum board under stairs, Fluorescent Lights • Exposed piping for wet pipe protection system
50.	South Wall	• Gypsum board – rippled, with 4” rubber base • 8’ Wood base and upper kitchen cabinet with metal sink – fair condition • Plastic laminate counter is delaminating • Door and hardware in poor condition
51.	West Wall	• Gypsum board with 4” rubber base • Baseboard electric heat
52.	North Wall	• Gypsum board with 4” rubber base • Double door frame was at one time much larger, door has been downsized • Double painted wood door to Exhibit Shelter in poor condition with sandbags at sill to keep out rodents • Doors have closers and magnetic hold open • Hardware in fair condition • Fire protection system vertical water pipe adjacent to wall
53.	East Wall	• Original east wall has been partially removed • A new east wall has been constructed for the room • Gypsum board with hole above 6x12 steel beam at top south corner • 4” rubber base
54.	Floor	• Concrete floor slab with carpet and sheet vinyl • Eight inch square access cover for PVC line test well near south door
(new room) CONCESSIONER STORAGE (Ground Floor) RM 103A		
55.	Ceiling	• Metal deck, Fluorescent Lights • Exposed steel beam structure • Exposed piping for wet pipe protection system

ITEM	COMPONENT	INVENTORY and ASSESSMENT
56.	South Wall	• Gypsum board, Built-in shelves • Door to Mechanical Room binds, but in fair condition • Door has door closer and magnetic hold open • Hardware is in good condition
57.	West Wall	• Strand board, Built-in shelves
58.	North Wall	• Gypsum board, Built-in shelves
59.	East Wall	• Gypsum board, Built-in shelves
60.	Floor	• Concrete floor slab
VISITOR GALLERY STAIR (GROUND and SECOND FLOOR) RMs 102 and 201		
61.	Ceiling	• See Exhibit Shelter
62.	South Wall	• Gypsum board – rippled • Wood studs in walls assumed to be damaged • Equipment storage (air compressor) unenclosed
63.	West Wall	• Gypsum board – badly damaged
64.	North Wall	• No wall
65.	East Wall	• No wall
66.	Stair	• Steel frame, stair pans and guardrail with concrete treads • Upper landing steel frame set in damaged CMU wall
67.	Floor	• Concrete floor slab
LOWER VISITOR GALLERY (GROUND FLOOR) RM 102		
68.	Ceiling	• Painted metal deck and exposed steel beams • Incandescent, fluorescent lighting, exposed conduit
69.	South Wall	• Gypsum board, 1x4 Base, New paint, Built-in exhibits • 1x Trim at wall/ceiling intersection pulling away from wall at ends • Paint deteriorated at interior window sills to Preparation Lab, Rm 104 • Three original windows to lab covered with gypsum wall board • Free standing exhibits adjacent to wall
70.	West Wall	• New wall constructed for Storage Rm 103A • Gypsum board damaged under second floor deck • Studs in wall assumed to be damaged
71.	North Wall	• No wall
72.	East Wall	• Partial steel window wall and glazed aluminum doors to Lower Lobby are not original • Doors are racked, bind, fair condition • Doors have door closers • Hardware is in fair condition • Original porcelain enamel sandwich panels at exterior wall have been removed and replaced with Plexi-glass window panels

ITEM	COMPONENT	INVENTORY and ASSESSMENT
73.	Floor	• Carpet on concrete floor slab • New concrete floor extension to Quarry face in northeast corner • Metal Guardrail – warped, top rail pulling apart, gate, wire mesh • East end of north guardrail removed to allow access to new quarry wall viewing platform
EXHIBIT SHELTER (OPEN TO BOTH LEVELS) RM 116		
74.	Ceiling	• Painted 2x wood deck, good condition, few split boards • Exposed and painted steel beams and purlins, good condition • Exposed expansion joint is cracked and deteriorated on under side • Expansion joint open to exterior at one point over north windows • Birds, bats, and insects can enter the building through the opening • Acoustic tile is coming off ceiling at different locations over visitors gallery • Poor joinery, gaps of ceiling to roof drain pipes due to building movement • Gantry crane frame and structure warped and non-operational • Gantry crane work platform is damaged and non-operational • Incandescent, fluorescent lighting, exposed conduit • Large pendant lights suspended from ceiling over Visitors Gallery • Floodlights over Visitor's Gallery rail illuminate quarry wall • Roof drain system modified from original 6-4 inch pipe drains to 1-4 inch pipe drain
75.	South Wall	• See Upper Visitor Gallery (Second Floor) and Lower Visitor Gallery (Ground Floor)
76.	West Wall	• Metal window wall pulled up ½" from concrete stem wall at driveway doors • Metal window metal openers bent • Metal window vertical I-beams/columns bent • Metal window screens are pulled away from the openings by the openers • CMU wall portion is crushed at the balcony north connection • Large double metal door frame is out of square • Large double metal doors have a man door, binds, poor

ITEM	COMPONENT	INVENTORY and ASSESSMENT
		condition • Double metal doors are sandbagged at the bottom to keep out rodents • 2x2 Metal horizontal lock bar for doors is bent • The doors are padlocked
77.	North Wall	• Metal window wall over concrete stem wall • A few concrete piers have spalled at their tops • A few hairline cracks can be seen in the concrete stem wall • Excavation has taken place almost directly below the stem wall footings • A few metal window muntins are rusted • A few window panes are cracked and sealant is deteriorating or has failed • Metal screens pulled away from window openings by the openers • Gantry crane rail attached to building columns is slightly bowed
78.	East Wall	• Metal window wall over concrete stem wall is the most damaged • Hairline cracks can be seen in the concrete stem wall • Excavation has taken place almost directly below the stem wall footings • Concrete piers have failed at their tops and steel columns plates are torn away • Metal window wall pulled up 4” from concrete stem wall at driveway doors • Metal window wall vertical I-beams/columns bent • Metal window wall connections to concrete piers & wall displaced horizontally • Visual separation between vertical metal window structure and concrete stem wall • Window pane glass is broken and some have been replaced with plexi-glass panels • Original porcelain enamel panels south of double doors replaced with plexi-glass • Large double metal doors at driveway replaced or closed off by T-111 panel
79.	Floor	• Carpet on viewing platform at quarry wall • Guardrail at east and west edge of viewing platform • Soil surface on driveway except at visitor viewing platform at east end of building • Gantry crane track runs length of building and is non-operational

ITEM	COMPONENT	INVENTORY and ASSESSMENT
		• Quarry wall is the remainder of the floor of this space • Water stood at some period at the driveway west end inside large doors • Original visitor gallery guardrail has been removed for access to quarry viewing platform • Visitor guardrail has been added to new view platform east and west edges
LOWER LOBBY (GROUND FLOOR) RM 112		
80.	Ceiling	• Partial metal deck and partial acoustic tile ceiling finish • Acoustic tile is badly cracked or racked at south end of room • One acoustic tile has fallen off substrate • Lighting is attached to tracks • Steel beam structure & metal deck is exposed at north end of room
81.	South Wall	• Gypsum board behind info desk is rippled and cracked • Birch plywood curved panels have shifted out of square • Wood door has been removed to new Information Room next to stair • Dutch wood door #1 and #2 to Office will not close, frames racked • Pass through window (Info to Office) has been added
82.	West Wall	• Partial gypsum board and partial steel window wall • Partial steel window wall is not original and is out of square • Three 52” floor cabinet heaters • Dutch door to corridor in poor condition, racked, difficult to close • Hardware jury rigged to accommodate moving wall and floor • Two steel casement windows, non-operational • Window hardware in poor condition or missing • No window screens • Two steel fixed windows • Blinds on all windows in fair condition
83.	North Wall	• Steel window wall is not original, has been moved north of original • Lobby expanded north into original Visitors Gallery • Original metal window wall and metal double doors have been removed
84.	East Wall	• Concrete stem wall with metal window wall above • Information desk adjacent to wall, shaded by vertical blinds

ITEM	COMPONENT	INVENTORY and ASSESSMENT
		• Concrete stem wall and piers are cracked • Metal window wall vertical I-beams are not vertical • Metal window wall muntins and mullions are racked • Metal window wall is pulled away from the main structure, sealant applied • Original porcelain ceramic panels replaced with scratched and bowed plexi-glass • Plexi-glass panels are coming out of the metal frames • Air conditioner jury rigged in to metal window wall • Aluminum glazed double entry doors and steel frame to exterior out of square • Glazed aluminum doors are in poor condition and bind • Integral lockset and two closers are in poor condition • CMU pilaster next to aluminum doors is cracked
85.	Floor	• Concrete floor slab tilted down toward the interior quarry wall of building • Carpet in poor condition • Exhibit cabinets are showing wear
OFFICE (GROUND FLOOR) RM 114		
86.	Ceiling	• Gypsum board, rippled, cracked • Fluorescent lighting
87.	South Wall	• Curved gypsum board, 1x4 Base, New paint • Seven steel casement windows, non-operational • Casement window hardware missing or in poor condition • Casement window screens missing or in poor condition • Seven steel fixed windows • One of seven steel fixed windows has an air conditioner cut into it • Blinds on all windows, poor condition • Four window frames displaced horizontally (3/4” max) • Floor cabinet heaters against wall, (some have been removed)
88.	West Wall	• Gypsum board, 1x4 Base, New paint • Built-in shelves over opening to information desk
89.	North Wall	• Curved birch plywood panels and trim with door transom panels • Dutch door to Information, poor condition, won’t close • Hardware in poor condition • Dutch door to Lobby, poor condition, binds • Hardware in poor condition, different on door two sides
90.	East Wall	• Original wall has been removed • New east wall installed to enlarge the original office

ITEM	COMPONENT	INVENTORY and ASSESSMENT
		space • Pocket door (non-operational) installed for access to Information
91.	Floor	• Carpet on concrete floor slab
SALES (GROUND FLOOR) RM 113		
92.	Ceiling	• Gypsum board, rippled • Fluorescent lighting
93.	South Wall	• Gypsum board, 1x2-1/2" Base, New paint, not original wall • Pocket door (non-operational) installed for access to the Office, good condition • Hardware in good condition but door won't close
94.	West Wall	• Curved birch plywood panels and trim with door transom panel • Door frame is racked, door has been removed • Information desk is adjacent to the door opening
95.	North Wall	• Gypsum board, cracked
96.	East Wall	• Curved gypsum board • Two steel casement windows, non-operational • Casement window hardware missing or in poor condition • Casement window screens missing • Two steel fixed windows • Blinds on all windows, poor condition • Floor cabinet heater against wall
97.	Floor	• Carpet on concrete floor slab
INTERIOR STAIR (GROUND AND SECOND FLOOR) RMs 112 and 202		
98.	Ceiling	• 2'x4' Acoustic tile • Fluorescent lighting
99.	South Wall	• Southeast orientation, gypsum board, rippled, tape joints raised
100.	West Wall	• Gypsum board • Wall opening to lobby with guardrail at ground floor and at stair landing
101.	North Wall	• Curved gypsum board • Eight steel fixed windows • Blinds in fair condition
102.	East Wall	• Open stair access • Metal guardrail gate at ground floor to stairwell for wheelchair storage
103.	Floor	• Carpet on concrete floor slab, landing, and on stair
104.	Stair	• Metal frame with concrete treads and metal rail, poor condition

ITEM	COMPONENT	INVENTORY and ASSESSMENT
UPPER LOBBY (SECOND FLOOR) RM 202		
105	Ceiling	• Acoustic tile, 2'x4', with water mark at skylight • Circular skylight, 4' diameter, translucent white • Fluorescent lights
106	South Wall	• Birch plywood curved and straight panels with trim, fair condition • 1x4 Base • Diorama wall is not original • Door to Office is not in original location • Drinking fountain and built-in diorama • Wood Restroom doors propped open (Operational?) • Sound of toilets flushing periodically (No one inside)
107	West Wall	• Gypsum board • Three steel fixed frame windows, fair condition • One steel casement window and screen in fair condition • Casement window handle is missing • Air conditioner cut into one fixed frame window • All windows have horizontal blinds in poor condition • Floor cabinet heaters, one has been removed • Exhibits adjacent to west wall
108	North Wall	• Steel window wall is warped • Aluminum glazed double doors to Visitor Gallery will not close, bind, and racked • Doors in poor condition, swing both ways • No hardware, hinges close the doors
109	East Wall	• Partial steel window wall and door frame is warped • Aluminum glazed double doors to exterior close but have large gaps to exterior • Doors do no open to 90 degrees, hit ramp, racked, bind, poor condition • Hardware in poor condition, integral locksets, door closers • Partial gypsum board wall with 1x4 base in fair condition • Metal exhibit guardrail warped
110	Floor	• Carpet • Floor substrate does not feel solid beneath the skylight
OFFICE CLOSET (SECOND FLOOR) RM 204A		
111	Ceiling	• Gypsum board, wavy, unpainted • Ghost imprint of original wall visible • Fluorescent lights
112	South Wall	• New stud wall, not original, no gypsum board • Wood door, fair condition, swings shut by itself

ITEM	COMPONENT	INVENTORY and ASSESSMENT
		• Hardware fair condition • Original information desk removed
113.	West Wall	• Curved gypsum board • One steel casement window, inoperable, handle missing • Window screen in fair condition • Window blinds in fair condition
114.	North Wall	• Diorama in a new wood stud wall, not original wall • No gypsum board, studs exposed • Built-in wood shelving
115.	East Wall	• Wood stud wall, not original • No gypsum board • Built-in wood shelving
116.	Floor	• Linoleum tiles
OFFICE (SECOND FLOOR) RM 204		
117.	Ceiling	• Gypsum board, wavy, • Fluorescent lights • Ceiling access panel at north wall near door to Lobby
118.	South Wall	• Gypsum board • 1x4 Base
119.	West Wall	• Curved gypsum board, 1x4 Base • Three steel casement window, 1 operable • All window screens are missing • Window hardware in poor condition or missing • One casement window displaced horizontally at bottom ½” • Two steel fixed windows • Air conditioner cut into 1 steel fixed window • Blinds in all windows, 4 out of 6 inoperable • One floor cabinet heater
120.	North Wall	• New gypsum board, 1x4 base • Original wall removed • 1x2 stained trim at wall top and edges • Door to Closet swings shut by itself • Door to Lobby not in original location, poor condition • Door has birch transom panel • Door to Lobby swings shut by itself • Hardware in poor condition • Built-in corner shelves at door to lobby
121.	East Wall	• Birch plywood curved panels with trim, fair condition
122.	Floor	• Carpet
JANITOR’S CLOSET (SECOND FLOOR) RM 206		

ITEM	COMPONENT	INVENTORY and ASSESSMENT
123	Ceiling	• Gypsum board • Incandescent light
124	South Wall	• Curved gypsum board • One steel casement window, won't close completely, rusty • Hardware in poor condition • No window screen • Two steel fixed windows • All window frames displaced horizontally ½"-1", can see outside • No Base
125	West Wall	• Gypsum board • Built-in wood shelves, not original
126	North Wall	• Curved gypsum board, hole in wall • Door, poor condition, rusty hinges, vent • Door has birch transom panel, painted one side • Hardware in poor condition
127	East Wall	• Gypsum board • Service sink with rusty fixture, operational
128	Floor	• Blue ceramic tile, broken, poor condition
MEN'S VESTIBULE (SECOND FLOOR) RM 205		
129	Ceiling	• Gypsum board • Walls
130	South Wall	• Curved gypsum board • Blue ceramic tile base • Door to Janitor
131	West Wall	• Gypsum board • Blue ceramic tile base
132	North Wall	• Curved gypsum board • Door to Lobby, poor condition, door warped, damaged grill, propped open • Blue ceramic tile base
133	East Wall	• Gypsum board • Blue ceramic tile base
134	Floor	• Blue ceramic tile
MEN'S TOILET (SECOND FLOOR) RM 207		
135	Ceiling	• Gypsum board • Fluorescent lights
136	South Wall	• Curved gypsum board • Metal frame windows, Hardware missing, Windows don't open • Poor ventilation, odors

ITEM	COMPONENT	INVENTORY and ASSESSMENT
		• Metal frame window with gap to wood frame, can see outside • Floor cabinet heater • Blue ceramic tile base, warped, chipped, pulling away
137	West Wall	• Gypsum board • Blue tile base • Lavatories operational
138	North Wall	• Curved gypsum board • Blue tile base • Metal toilet partitions, painted • Water closets operational
139	East Wall	• Gypsum board • Urinals operational
140	Floor	• Blue ceramic tile, wavy
WOMEN'S VESTIBULE (SECOND FLOOR) RM 209		
141	Ceiling	• Gypsum board
142	South Wall	• Gypsum board • Blue ceramic tile base, warped
143	West Wall	• Gypsum board • Blue ceramic tile base, warped • Door to Lobby, poor condition, door warped, propped open, no hardware • Door won't close • Door has birch transom panel
144	North Wall	• Curved gypsum board • Blue ceramic tile base, warped
145	East Wall	• Gypsum board • Blue ceramic tile base, warped
146	Floor	• Blue ceramic tile, patched, warped
WOMEN'S TOILET (SECOND FLOOR) RM 208		
147	Ceiling	• Gypsum board • Fluorescent lights
148	South Wall	• Gypsum board • 4" Rubber base, Original ceramic tile base has been removed • Metal toilet partitions, painted, 1 latch does not work • Water closets, 2 out of 4 operational, 1 continues flushing
149	West Wall	• Curved gypsum board • 4" Rubber base • Birch door to Women's Vestibule, poor condition • No hardware, no closer

ITEM	COMPONENT	INVENTORY and ASSESSMENT
		• Door won't close
150	North Wall	• Gypsum board • 4" Rubber base • Lavatories in counter operational • Counter backsplash pulling apart at center
151	East Wall	• Curved gypsum board • 4" Rubber base • Three steel casement windows, hardware missing, 1 window operable • Two casement windows have screens, screens are in poor condition • Four steel fixed windows • Poor ventilation, odors • One floor cabinet heater
152	Floor	• Blue ceramic tile, wavy, patched
UPPER VISITOR GALLERY (SECOND FLOOR) RM 201		
153	Ceiling	• See Exhibit Shelter, Rm 116
154	South Wall	• Steel window wall with glass panes on wood framed wainscot wall • Some broken or cracked glass panes • Exhibits adjacent to window wall on floor • Large steel columns approx. 20' OC • Partial steel window wall and glazed aluminum doors to Lobby
155	West Wall	• Steel window wall with glass panes
156	North Wall	• No wall • Metal square pipe rail frame with screen infill • Metal railing is warped both horizontally and vertically • Metal railing screen and frame pulled away from railing frame • Metal railing top rail is distorted and pulling apart
157	East Wall	• Steel window wall with glass panes
158	Floor	• Carpet on concrete floor slab on metal deck, springy and tilted down toward the north • Metal balcony fascia warped both horizontally and vertically • Metal Guardrail – warped, top rail pulling apart, wire mesh • Stair at west end of gallery – See Visitor Gallery Stair (Ground Floor) Rm 102 • New gallery deck extended to east window wall from original deck end • New metal railing added to west and north new gallery

ITEM	COMPONENT	INVENTORY and ASSESSMENT
		deck

Structural Condition Assessment

Existing Conditions and Findings

The Quarry Visitor Center was constructed in 1957-58 as a museum/exhibit building to enclose and display a large sandstone outcrop bearing numerous fossils from the Jurassic Period. It also provided laboratory spaces with offices for the paleontologists working the active fossil quarry. As-constructed drawings of the original structure are filed under drawing number NM:DIN/3102E and are included in this document for reference. The building is composed of four subunits. These subunits are the large exhibit shelter, the one-story south wing containing laboratory, employee offices, library, and mechanical rooms, the two-story circular element called the administrative wing containing restrooms, offices, and concessioner sales areas, and the serpentine concrete visitor entrance ramp. (See Photo (A) on Sheet EX01 in Appendix C.)

Exhibit Shelter

The exhibit shelter is built around the fossil quarry. The quarry is excavated in a thick sandstone stratum that is inclined at approximately 65 degrees to horizontal. The base of the quarry is at the floor elevation (approximate elevation 5182') and the top edge of the quarry is at an elevation approximately 35 feet above the floor. The exhibit shelter is a solarium approximately 60 feet wide by 180 feet long in plan dimensions. The roof over this solarium rises up the face of the quarry at a 4 to 12 slope and reaches more than 50 feet above the floor at its high point. See Photo (C) on Sheet IN18 in Appendix C.

Ten steel rigid frames spaced 20 feet on centers frame this area. A 3-foot high concrete wall on a 2-foot deep concrete footing cast on the fossil-bearing sandstone outcrop supports a 12-foot high steel-framed window wall along the north wall of the exhibit shelter at the high edge of the quarry. The east and west walls of the exhibit shelter space are also steel-framed window walls supported on concrete foundation walls. The north halves of the east and west walls bear on concrete footings cast in the sandstone stratum. The south halves of the east and west walls of the exhibit shelter space bear on concrete stem walls supported by shallow concrete strip footings that bear on decomposed shale and soil strata above the quarry sandstone stratum.

An elevated visitor gallery approximately 14 feet wide projects from the south wall of the exhibit shelter at an elevation of 12 feet above the floor level and runs the length of the building. The floor system of the visitor gallery is concrete fill on metal decking. The south wall at the lower floor level of the solarium is constructed of wood framed interior partition walls filling between steel columns from floor surface to the underside of the visitor gallery decking. Above the visitor gallery, a steel-framed window wall extends from the elevated gallery level to the underside of the roof deck. (See Photo (A) on Sheet IN16 in Appendix C.)

The large window walls on all four elevations are framed similarly. Wide flange steel sections 10" deep and spaced 10 feet apart span vertically from top of concrete wall to underside of steel

butterfly frame along the east and west walls and span from top of concrete wall to steel channels at the underside of the roof deck along the north wall. The 10" deep steel "columns" in the south window wall are supported by the steel roof beams that span across the south wing and support the elevated gallery. The steel channels along the top of the north and south walls frame into the steel butterfly frames and transfer wind load from the top of the vertical wide flange sections to the steel frames. Horizontal wide flange sections (4" deep) span between vertical steel sections at 10 feet spacings. The result is an orthogonal rigidly framed steel vierendeel truss system for each wall with each 10 feet by 10 feet bay subdivided into 9 square glass panels by steel sash sections.

The roof of the exhibit shelter is framed of 2x6 tongue-and-groove wood decking supported by steel framing. The main elements of the roof framing are the ten steel "butterfly" frames. These rigid frames are fabricated of tapered wide-flange steel sections. The frames are composed of two beams and one column in an eccentric "Y" shape. The longer roof beams span 59 feet over the fossil quarry and the far ends are rigidly connected to the tops of steel columns in the north wall. The shorter roof beams of the rigid frames cantilever to the south 15 feet to support a shade roof that overhangs the south solarium window wall. Steel purlins span between rigid frames at approximately 5'-3" spacings to support the tongue-and groove timber decking. The steel columns of the "butterfly" frames taper from 30" wide at the top to 24" wide at the base. The rigid steel frame columns bear on shallow 2-foot deep by 5'-8" square concrete pads founded on bentonitic shales which overlie the inclined fossil-bearing sandstone strata.

South Wing (Employee Office/Laboratory Space)

Adjacent to and running along the south edge of the exhibit shelter is the employee office/laboratory space. This part of the building is a one-story unit approximately 20 feet wide and 160 feet long. The south, east, and west walls of this unit are built of reinforced concrete masonry units. The south masonry wall bears on a concrete stem wall with pilasters spaced at 10 feet. The concrete foundation wall acts as a retaining wall to hold the exterior grade several feet above the floor elevation. The short concrete wall is built on a shallow concrete strip footing. The CMU masonry walls of the east and west walls extend below grade and bear on concrete strip footings. The west and south walls are exterior walls. The east wall separates this portion of the building from the administrative wing of the building. An interior wood-framed partition wall separates the space in the south wing from the exhibit shelter space at the lower level. Wood-framed partition walls also run transverse to the long axis of this area to divide the wing into six rooms and a corridor. The floor in this portion of the building is concrete slab on grade. The interior partition walls bear on the floor slab and generally frame to the underside of roof beams. (See Photo (E) on Sheet EX12 in Appendix C.)

Tapered steel roof beams spaced 10 feet apart are anchored to the top of masonry pilasters built integrally with the south masonry wall. The roof beams span 20 feet across the width of this area and support the roof and the south window wall of the exhibit shelter. The beams extend north across transverse steel support beams framed into the side of vertical webs of the large steel "butterfly" frame columns along the south wall of the exhibit shelter and cantilever 18 feet into the exhibit shelter space to support an elevated visitor gallery platform along the south wall of the exhibit shelter. The steel roof beams taper and originally were constructed so the bottom

flanges were level and the top flanges provided a 1/4" per foot slope to the south edge of the roof. Tongue-and-groove timber decking span across the roof beams over the laboratory/office wing to support the roof. Due to the uplift of the south wall, the roof beams now appear as though they were to be level on the top flange and rising to the south along the bottom flange. (See Photo (B) on Sheet IN05 in Appendix C.)

Administrative Wing

The administrative wing of the building is located on the southeast corner of the building. This portion of the building is a two-story cylindrical reinforced concrete/masonry-walled unit. This space contains a concessions sales lobby and two offices on the lower level with an exhibit lobby, an office, and restrooms on the upper level. A stairwell connects the two levels. The lobbies on each level interface the exhibit shelter of the building with the upper level flowing onto the visitor gallery and the lower level extending into the solarium space of the exhibit shelter area. The two-story exterior reinforced masonry walls are built in cylindrical shape and bear on concrete stem walls with shallow concrete strip footings. (See Photo (A) on Sheet EX02 in Appendix C.)

The roof and second floor systems of the administrative area are constructed of timber decking spanning across steel beams and timber joists. The joists are supported near the center of the space by wood framed interior walls built in the shape of a partial cylinder with a diameter of approximately 12 feet. These interior walls and the interior stairwell walls in this space bear on concrete stem walls supported by very narrow shallow concrete strip footings. The second floor and roof joists radiate from the center of the space and span to the exterior CMU walls. The first floor is a concrete slab on grade. The main entrance to the building is located where this administrative wing of the building meets the exhibit area at the top of the concrete ramp which is at the second floor/visitor gallery level.

Concrete Visitor Entrance Ramp

A serpentine curved cast-in-place concrete access ramp located just outside the eastern edge of the cylindrical administrative wing climbs from grade at the first floor/parking lot level to the second floor main entrance threshold. The 6-foot wide entrance ramp is continuous over four concrete support pedestals and was originally supported below the door threshold with steel building framing. The low end of the ramp which was originally built with several steps at the flared ramp entrance is supported by a shallow concrete abutment.

Existing Conditions

The building has displayed symptoms of structural distress such as floor heaving, wall cracking, door frame movement, and glass breakage since its construction in 1957. Numerous small repair contracts and continuous maintenance efforts have tried to stabilize the building. Although most of these efforts have improved conditions, the building is still disintegrating. Differential movements of up to 10 inches between various portions of the building foundation system have caused most, if not all, of the structural distress. The moisture sensitive and expansive supporting soils and bedrock have been flooded with water from utility line ruptures, broken

wastewater piping, and roof drain connections to perforated buried french drains at various times over the history of the building. Groundwater is constantly present under some portions of the building but not under the entire building. The static level of the groundwater just north of the building is approximately 10 feet above the first floor elevation. Water pipe breaks with significant water loss to the underlying soils have caused significant short-term movements of foundation elements on several occasions in the past including 1966, 1978, 1983, and 1990. After each of these flooding events, major structural damage including broken supports and anchorages occurred. (See Photo (B) on Sheet EX05 and Photo (A) through (F) on sheet EX16 in Appendix C.)

Site Geology

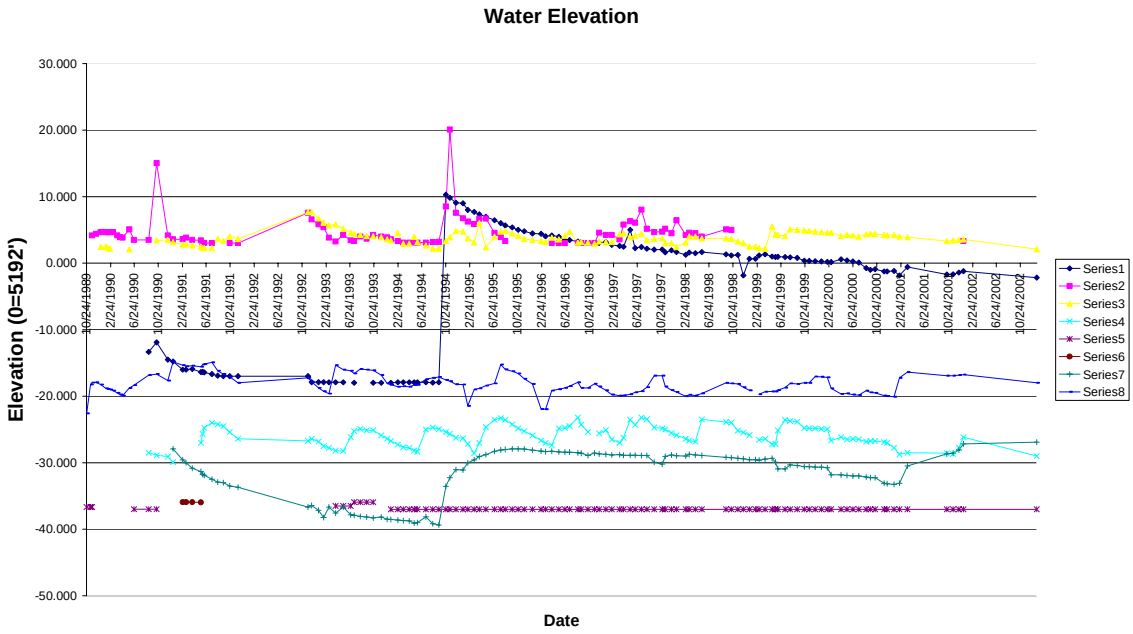
The structural problems are caused by shallow foundation elements generally under the south half of the building rising relative to the foundation elements built on the outcropped sandstone on the north side of the building. This differential movement is related to the peculiar site geology. A 1966 soils investigation by Dames and Moore determined the following subsurface conditions:

- The building is founded on the Morrison formation which consists of alternate layers of shales and sandstones with some limestone.
- The stratification dips to the south at an angle of 65 degrees from horizontal. The strike of the formation is essentially parallel to the south wall of the building.
- The north half of the building is supported on a hard weather-resistant sandstone layer.
- The south end of the building is founded on exposed edges of the shale layers.
- These shale layers were originally firm to very hard when exposed but have lost strength and slaked after being exposed to air and water.
- The shales contain bentonitic layers which are very moisture sensitive and exhibit large volume changes with changes in moisture content.
- A thin limestone layer is exposed at the ground surface approximately 20 feet south of the south wall of the rectangular building. Limestone strata may contain solution cavities.
- The residual surface layer (approximately 2 feet thick) is moisture sensitive and expansive. During the period from original construction (1957) to the 1966 date of the soils investigation, the upper eight or more feet of shale had decomposed from hard shale with a density of 150 pcf to a residual soil with a density of only 100 or 120 pcf. This could have caused a 10 to 20 percent volume expansion of the supporting shale strata.
- Because of the steep dip of the fossil-bearing outcropped sandstone layer, the depth of shales under the south portion of the building exceeds 30 feet.
- If the shale continues to decompose below the upper 8 feet under the south side of the building, additional expansion will continue to lift the building.

A 1989 soils investigation by Chen-Northern, Inc. found the various strata below the building possessed low to very high swell potential. Values of swell potential varied from 0 to 14 percent under a 1000 pound-per-square-foot pressure with swell pressures ranging to over 20,000 psf. Typical values were in the 2 to 7 percent range with swell pressures ranging from about 8,000 to over 20,000 psf. The moisture content of samples ranged from 3.5 % to 37.5% in the samples

tested. The degree of saturation of near surface soils ranged from about 60% to nearly 100% with no consistent pattern evident in most borings. The report of findings recommended utilities be isolated and surface water controlled to minimize moisture in the subsoils. The report also recommended underpinning the building foundations with straight-shaft drilled concrete piers to reduce the potential for future movement.

Soil borings made by Chen-Northern for their investigation were lined with PVC pipe in order to allow ground water accumulation to be monitored. Water accumulated in only 2 of the 13 holes. A hole under the mechanical room accumulated fluctuating levels of water while a hole just north of the building at midlength was originally dry but accumulated water to a depth 24 feet below top of hole. The park maintenance staff continued monitoring these wells on a monthly basis for twelve years. The records indicate 4 of the holes have remained essentially dry while the others accumulate fluctuating depths of water over time.



Measured Groundwater Elevations in Site Borings Since 1989

Condition of the Exhibit Shelter Portion of the Building

Expansive soils under the shallow foundation pads of the rigid steel "butterfly" frames and the adjacent integral strip footings of the east and west walls lifted the steel columns of the exhibit shelter at both the east and west ends of the building soon after construction. This movement caused the framing of the east and west window walls of the exhibit shelter to skew. The original glazing panels (3 feet square glass panels) were stressed with diagonal tension and shear. Many cracked and failed. (See Photo (A) on Sheet EX08 in Appendix C.)

In 1967, a construction contract was let to underpin the foundation along the east and west walls at the south half of the exhibit area. Concrete piers were placed in holes drilled 20 feet deep beneath new concrete grade beams which replaced the foundation wall at the large double doors

near the base of the fossil quarry at both the east and west ends of the building. In addition, the foundation pad beneath the steel column of the "butterfly" frame in the east wall near the entrance doors (at building grids (B) and (10)) was underpinned with four concrete piers drilled to 40 feet depth. Roof drainage was rerouted to avoid spilling off the roof at the east and west ends of the roof valley near the steel frame columns and footings. (See Photo (E) on Sheet EX02 in Appendix C.)

The west wall of the exhibit area has remained relatively stable since the 1967 repair. However, the east wall has continued to move and distort. The interior column just west of the underpinned column (at building grids (B) and (9)) has also been lifted by soil expansion. This movement appears to result from the continued uplift of the footings beneath these columns. Both of these column footings are built integrally with adjacent foundation walls and the narrow strip footings beneath them. The integrated construction allows load to be redistributed from the base of the columns to the adjacent foundation walls and footings. This results in much lower bearing pressures on the soils beneath these two columns relative to the other eight rigid frame columns. Water has infiltrated the soils in this area of the site from roof drains, site drains, broken water supply piping, and broken sewer piping. The structural distress caused by the movement of these columns is manifest in several ways. (See Photos (D and E) on Sheet EX18 in Appendix C.)

The framing for the east window wall is fastened to the main steel column and the rest of the rigid steel "butterfly" frame above the east wall. The uplift of the main column has rotated the entire frame and attached window wall about the point where the north column rests on the concrete stem wall at the northeast corner of the exhibit area. The window wall has been lifted off the foundation wall and is being suspended by the overhead steel frame roof beam. In order to free the steel framing of the glazed wall from the foundation wall, several steel jamb columns were pulled from the top of their supporting concrete pilasters. In one instance, the top of the pilaster was broken. In order to accomplish these movements, the yielding or breaking of four 5/8-inch diameter steel anchor bolts per jamb column connection was required. This demonstrates both the large force uplifting the main column footing and the resistance to uplift of the east wall's concrete foundation. (See Photos (E) on Sheet IN21 and (D) on Sheet IN22 in Appendix C.)

The movement of the east wall altered the geometry of the northeast corner of the building. Because the crane rail of the quarry scaffolding gantry is supported off hangers attached to the steel columns along the north wall, the gantry crane rail was pulled out of alignment by the movement of the hanger attached to the northeast column. This caused the north wall crane trolley to jamb when it approached the northeast corner. The hangers are somewhat adjustable. The maintenance staff has realigned the upper rail of the scaffold gantry on prior occasions to allow the gantry to move properly across the face of the fossil quarry. The gantry is currently out of service due to a failure of the scaffolding rigging. The geometric misalignments that inhibit the gantry travel may be aggravated by shallow soil uplift under the lower (south side) gantry rail near the east wall. (See Photo (B) on Sheet IN25 in Appendix C.)

The uplift of the two rigid frame columns in the southeast corner of the exhibit shelter also distorts glazing framing in the east wall and the south wall of the exhibit area at the east end.

The pattern of glass breakage in the south wall of the solarium above the elevated visitor gallery indicates the westernmost eight frame columns are relatively stable but the column in the east exterior wall and the adjacent column is experiencing uplift. The uplift of the interior column is less than that of the exterior column.

The concrete slab-on-grade floor at the first floor lobby between the steel frame column in the east exterior wall and the adjacent column has lifted considerably since construction. The floor slab was replaced in 1983 because the movement had created a safety hazard. The floor slab was replaced again in the 1990's because its movement was causing serviceability problems related to door operation and interior wall cracking. The park staff feels the slab is still moving but at a slower rate. The floor movement has caused some minor distress to the interior steel framing and glazing at the east lobby. This interior framing was installed in 1967 at the same time the underpinning project was constructed. The current buckling of some of the framing indicates significant uplift has occurred since 1967. (See Photo (C) on Sheet IN02 in Appendix C.)

In 1989, the entry doors on the east façade and appurtenant framing also showed distress effects caused by the uplift of the east rigid frame columns. The door frame was skewed with the south jamb higher than the north jamb at both the first and second floor doors. The second floor door frame had pulled away from the administrative wing of the building leaving a ½ inch wide gap between the south edge of the doorway frame and the masonry wall of the administrative wing. A large crack in the pavement east of the east exterior frame column ran east from the column face to the parking lot. This crack and the gap around the door frames indicated that the administrative wing was drifting laterally south away from the exhibit shelter unit of the building.

During the 1990's, the vertical movement of the administrative wing was much greater than the exhibit shelter. This caused the framing to rack in the opposite direction with the south jambs being raised above the level of the north jambs. The park staff indicate that the building moves enough on a regular basis that the squareness of the entry doors is constantly varying. (See Photo (E) on Sheet EX03 in Appendix C.)

The fossil quarry face serves as part of the north wall of the building. The rock face is jointed and cracked. The face of the quarry moves. The staff paleontologist indicated that isostatic rebound may be occurring now that the geologic strata have been relieved of a very large overburden by the quarrying operations. This phenomenon results in the expansion of precompressed rock strata after overburden pressure is removed. The strata beneath the fossil-bearing sandstone may be expanding and pushing the face of the quarry into the building. The static groundwater table is 10 feet above the base of the quarry in the strata underlying the sandstone. Moisture occasionally migrates through the sandstone and can be seen on the face of the quarry.

Condition of the Entrance Ramp

The serpentine curved concrete entry ramp was rigidly connected to steel framing in the east exterior wall of the building south of the steel "butterfly" frame column. A 10-inch deep steel beam spans the 8-foot width between the steel frame column and the cylindrical administrative

wing to the south. This beam was welded to the south flange of the steel frame column and supported the upper end of the concrete ramp at the entry threshold. When the "butterfly" frame column and integral wall construction of the east wall lifted, the upper end of the concrete ramp was forced to rise with the wall framing and column.

The administrative wing has raised several inches since construction and lifted the south end of the ramp support beam. This uplift tried to pull the ramp off the top of the nearest support pedestal. Cracking at the underside of the concrete ramp slab near the tallest support pedestal (pier 1) indicates the ramp uplift was stressing the pedestal with uplift forces. A study of the ramp by the Western Bridge Design office of the Central Federal Lands Highway Division of the Federal Highway Administration (FHWA) indicated in a May, 1995 report that the force required to break the ramp support was nearly 300,000 lbs. The resistance of the ramp system to this uplift force caused the transverse steel support beam to break the vertical weld connecting the support beam web to the "butterfly" frame column flange. This transferred the ramp support reaction to the ledge angle located beneath the north end of the support beam and welded to the bottom flange of the transverse support beam and the south flange of the "butterfly" frame column. (See Photo (A) on Sheet ST32 in Appendix C.)

The ledge angle was severely distorted and began peeling from the column. The concrete ramp slab sheared at the steel beam support and dropped several inches below the support point. This failure occurred in 1983 about the time a water main inside the building broke and released a large flow of water to the surrounding soils. The ramp is now supported by supplemental steel framing added in 1988 to shore the upper end of the ramp at the face of the building and carry the load to the foundation under the east wall of the building. The ramp is not reinforced adequately to cantilever the 20 feet from the nearest support pedestal to the east face of the building and support its own weight let alone the weight of the entering visitors. Therefore, if the supplemental steel shoring at the east face of the building is removed, the ramp will become unstable. (See Photos (G) on Sheet EX03 and (A) on Sheet EX05 in Appendix C.)

In addition to (but not necessarily related to) the structural distress at the top of the ramp, there was a structural failure of the second lowest support pedestal (pier 3). The ramp slab lifted off the top of the support pedestal entirely. This lifting process yielded the interconnecting reinforcing bars including six #8 and two #4 steel reinforcing bars. The distortion of the reinforcing bars caused concrete to spall from the underside of the ramp. (See Photo (D) on Sheet EX06 in Appendix C.)

Although the ramp sags between the two adjacent supports, it does not bear on the broken pedestal at all. The 1995 FHWA ramp study report determined this failure was probably caused by the uplift of the bottom of the ramp and the adjacent shorter pedestal (pier 4). The report indicated 100,000 lbs. of tension was required to fail the concrete at this support. The foundation conditions under this pedestal may have been aggravated by the piping of soil from beneath the pedestal footing into a buried french drain pipe that runs adjacent to this pedestal footing. One of the three original roof drains at the perimeter of the administrative wing daylights at the bottom of the wall near this pedestal. An exploration of the foundation conditions under the broken pedestal documented in a 1989 memorandum discovered a roof drain installed in the 1960's to drain water ponding in the center of the administrative wing roof was discharging into the

sanitary drain piping serving the restrooms. The sanitary drain pipe had broken and soil was leaching into the pipe from near the pipe break and soil was saturated beneath the pedestal footing.

Shoring was installed in 1991 to support the ramp at the location of the third pier and keep the plastic hinge in the ramp located over the second pier from allowing the ramp to sag between the second and fourth piers. Although this shoring is adjustable, it is currently barely touching the underside of the ramp. This indicates the ramp and its supports continue to move. (See Photo (B) on Sheet EX06 in Appendix C.)

Cracks in the concrete walls of the ramp indicate the reinforcing steel in the concrete walls has stretched beyond its elastic range at two locations. These locations are over the first and fourth piers. Shoring at the entrance to the building supports the upper end of the ramp and keeps the plastic hinge over the first pier from allowing the top portion of the ramp to fall. Although the shoring was installed to support the full width of the ramp slab, the ramp currently bears only on the south edge. The park staff indicated that the ramp sometimes bears only on the right edge. This indicates that the steel framing in the south wall of the building and/or the supports of the ramp move in a cyclical fashion and may be subject to fatigue stressing. (See Photo (B) on Sheet ST32 in Appendix C.)

Condition of the Employee Office/Laboratory Area (South Wing)

Other structural distress seen in the building is caused by the uplift of the south wall and interior wood-framed walls of the employee/lab area (south wing), uplift of the interior and exterior walls of the adjacent administrative unit, and uplift of the floor slabs in these areas. In the last 20 years, the floor slabs under the south wing have continuously lifted due to the expansive soils beneath. The heave of the floor slabs pushes the interior wood-framed room separation walls into the underside of the roof/gallery support beams. This uplift and the uplift of the south wall of the laboratory/office area has lifted the south end of the roof beams which bear on masonry pilasters built into the south wall. Because the roof beams cantilever into the south side of the exhibit area to support the visitor gallery, the uplift at the south end of the beams has caused the north edge of the visitor gallery to drop several inches. (See Photos (E) on Sheet IN10 and (C) on Sheet IN17 in Appendix C.)

Nine of the sixteen concrete masonry pilasters built integral with the south wall have cracked at the top around the anchorages of the roof/gallery beams. Although this appears to be cracking of the CMU face shell caused by the rotation of the beams, it may indicate yielding of the anchorages. If the anchorages failed, the visitor gallery could collapse. To prevent this potential catastrophe, the south ends of the roof beams over the laboratory/office space (south wing) were fitted with new anchorages to the south wall. These new anchorages consist of a pair of ¾" diameter steel rods which fasten to the bottom flanges of the roof beams and connect to a steel angle bolted to the interior face of the concrete foundation wall along the south wall at an elevation 1 or 2 feet above the interior floor slab.

Although the supplemental anchorages built in the early 1990's were considerably stronger than the originally designed anchorages, it is possible that the force being exerted on the underside of

the roof beams by the expanding soils under the floor slab is enough to fail the anchorages. If the beam anchors fail, with a significant load on the visitor gallery, the gallery deck will rotate plunging toward the edge rail. The cracks in the masonry pilaster should be closely monitored for further movement. Continuing deterioration and crack development in adjacent masonry pilasters may indicate the visitor gallery beam anchors are endangered again. (See Photo (C) on Sheet ST32 in Appendix C.)

The uplift of the roof beams over the laboratory/office wing also lifts the south window wall of the exhibit shelter along the south edge of the elevated visitor gallery because the window wall framing is supported on the roof beams one foot south of the transverse support beams which span between "butterfly" frame columns along the south wall of the exhibit shelter. With the fulcrum of support for the roof beams located at the "butterfly" frame columns' centerline and the vertical mullions of the south window wall in the solarium fitting between the top of the roof beams and the underside of the upper roof at the roof valley. Upward movement of the south wall lifts the ends of the roof beams and causes them to act as levers to pry the window mullions up against the underside of the upper roof. This compression in the window mullions and these small movements of the window wall framing cause the operable windows of the south solarium wall to jamb and results in window panes fracturing and falling onto the elevated visitor gallery in some locations. (See Photos (D) and (E) on Sheet ST32 in Appendix C.)

Every interior partition wall of the laboratory/ office wing which frames along a north-south axis displays diagonal shear cracking on the face of the wall finishes. Every door in these walls continuously racks out of square with the south jamb rising relative to the north jamb. The park maintenance staff continuously patch walls and replace doors. Employees occupying offices in this wing have constructed wooden platforms under their workstations to provide a level floor surface under their desks and chairs. Working in this space is frustrating for the employees because it is difficult to maintain a level surface and there are constant operational difficulties caused by movement of the sloping floor and wall framing. This active distress indicates that the south wall and the concrete floor slab in this wing of the building are still unstable. (See Photos (C) on Sheet IN05, (E) on Sheet IN04, (C) on Sheet IN12, and (F) on Sheet IN10, (F) on Sheet ST32, and (A) on Sheet ST33 in Appendix C.)

The roof over the south portion of the building was originally constructed to drain to the south wall at a slope of 5 inches in the 20-foot width of the roof. By 1987, the south wall of the laboratory/office wing had risen at least 10 inches relative to the "Butterfly" frame columns since construction. The roof over the laboratory/office spaces sloped to the north ponding water along the exterior face of the wall along the south edge of the elevated visitor gallery. The known depth and expansive characteristics of the shale strata beneath the south wall indicate a potential volume change in these strata that may continue to lift the walls and floor slabs in this wing indefinitely and endanger the structural integrity of the wing, visitor gallery, and south solarium window wall.

Condition of the Administrative Wing

The administrative wing of the Quarry Visitor Center, located at the southeast corner of the building, projects south of the rest of the building. It has experienced uplift similar to that of the

south wall of the laboratory/office wing. The building is very rigid due to its well reinforced concrete/masonry perimeter wall and diaphragms at the roof and second floor level. Therefore, initial cracks noted in the 1980's were generally well distributed and differential movement within the unit was restrained, but the unit as a whole had lifted significantly in its first 20 years. Continuing foundation movements over the last 20 years have begun to distort the shape of the building and have resulted in some large cracks in the exterior wall. (See Photo (D) on Sheet EX10 in Appendix C.)

The roof of the administrative wing was originally constructed with three roof drains located around the circular perimeter of the roof. A roof drain near the center of the roof was installed several years after construction indicating the exterior walls lifted relative to the interior center supports. This would have caused radial roof framing to change from sloping to the perimeter drains to sloping inward and ponding water at the center of the roof. The added drain at the center of the roof area was piped to the sanitary sewer serving the restrooms. This sewer piping had broken in the 1960s at the location along the west wall of the administrative wing where the outlet pipe penetrated the foundation wall. The sewer repair included an oversized opening in the foundation wall to allow a 2" wide collar around the sewer pipe at the wall penetration. In 1989, the sewer was found to be broken again and was discharging water and saturating the soils beneath the administrative wing and the third pedestal of the ramp.

By 1987, the roof was ponding water against the exhibit shelter south wall. This indicated that the administrative wing had risen even more than the steel rigid frame column in the east wall of the exhibit shelter. Because framing and foundation elements connect and integrate the administrative wing to the exhibit shelter, uplift of the administrative wing reduced load and bearing pressure on the footings of the two easternmost exhibit shelter columns. The reduced footing loads allowed uplift pressures from the soils to have a greater affect on these columns than the other eight frames in the exhibit space. The piping of roof drains below grade, the failure of water supply pipes, and the blocked outlet of the proximate buried perforated site drain system all contributed water to the soils beneath this area of the building. This may be why the two easternmost rigid frame columns are lifting while the other eight rigid frame columns appear stable. (See Photos (B) and (C) on Sheet ST33 in Appendix C.)

In early 1989, new distress was discovered in the administrative wing of the building. Previously, many well distributed tight hairline cracks around the exterior masonry walls indicated the structure of this unit of the building was not seriously overstressed. Unfortunately, two new distress locations appeared in 1989 and indicated the unit was experiencing differential movement of its foundations which could eventually cause serious overstresses. (See Photo (D) on Sheet ST33 in Appendix C.)

The first indicator was the buckling of a second floor ceiling gypsum board panel. One edge of a ceiling panel pushed free of its fasteners and deflected in excess of an inch. The pressure required to push the panel back against its support framing indicated the panel was experiencing considerable compression in its plane. This means the roof was resisting excessive compression loads which were caused by the west edge of the cylinder heaving more than the east edge. (See Photos (D) on Sheet IN28 and (E) on Sheet ST33 in Appendix C.)

The other indicator of differential movement seen in 1989 was the formation of two new diagonal cracks in the exterior masonry wall at the southwest edge of the cylinder. These cracks are different from the typical tight hairline cracks spread throughout the unit. They are wider than usual and they are oriented diagonally. They quite likely formed simultaneously with the ceiling buckling. Either the exterior masonry walls cracked due to excessive shear wall stresses and an increased load in the roof diaphragm system caused the ceiling panel to buckle or the ceiling panel, which was inadvertently carrying in-plane tension and compression stress as a secondary system, buckled causing an instantaneous increase in shear stress in the exterior wall which caused the two shear cracks to form. The diaphragm capacity of the roof system and the shear strength of the exterior walls were reduced. (See Photo (F) on Sheet ST33 in Appendix C.)

The administrative wing continues to distort in shape. This element of the building is very tough and stiff due to its cylindrical geometry and well reinforced masonry/concrete wall construction, welded steel floor framing, and diaphragms at the second floor and roof level. It is being distorted from a circular shape into an elliptical shape by the differential movement of the foundations under interior and exterior walls. The pattern of cracks and changing shape of the administrative wing indicate that the exterior walls are sagging at the north and south ends across a high ridge that runs east to west under the middle of the cylinder. This causes the roof plane to stretch in the north-south direction and buckle in the east-west direction while the base of the walls move apart in the east-west direction and droop at the south end. Inspection conducted for this report in 2003 found the elastic roof membrane has been stretched and torn in the long direction of the ellipse and is buckled in the short direction of the ellipse due to the change in building shape. (See Photo (A) on Sheet ST34 in Appendix C.)

The recent inspection also found the wood ledger beam supporting the roof framing has separated from the supporting masonry wall in at least one location. One of the roof joists has been stretched to the point of tearing free of its connection bolts. Adjacent roof joists have split at their bolt holes and are unlikely to resist additional tension along the length of the joists. (See Photo (B) on Sheet ST34 in Appendix C.)

Other structural distress discovered in the administrative wing includes spalled concrete from around a steel beam that spans across the door between the administrative wing and the main interior hall of the south wing. This link beam connects the administrative wing to the steel butterfly frame column and supports second floor framing of the administrative wing. The spalled concrete resulted from the deformation of the steel beam caused by the differential movement of the administrative wing and butterfly frame column. (See Photo (C) on Sheet ST34 in Appendix C.)

Another significant area of distress is located at the top of the stairwell in the administrative wing at the end of an interior partition. At this location, the gypsum sheathing is buckling away from the face of the framing at the end of the wall. This indicates that the wall framing has been overstressed in compression and is failing. This is especially significant because there is a steel pipe column built into this interior wall just 30 inches from the end of the wall. The steel column supports steel beams framing both the roof system and the second floor. The distress at the end of the wall shows there are significant compressive forces using alternative paths of resistance in the vicinity of a critical column to support the roof and floor framing of this part of the building.

(See Photos (D) and (E) on Sheet ST34 in Appendix C.)

One major concern with this portion of the building is the welded joints of the steel framing in the roof and floor systems and the integration of this steel framing with the large steel frames and gallery of the exhibit space. These welded joints can restrain loads in the range of 50,000 to 100,000 lbs. Because of the movement and distortions this portion of the building has experienced, the level of stress and fatigue in these welded steel joints is unknown. Because the dead load of this portion of the building is probably near 500,000 lbs and because the soils underlying the floor slab and footings are known to contain material that can lift 20,000 lbs/sq.ft., a large amount of the weight of the structure can be hanging on a small portion of the welded steel framing.

If one of the welded steel joints fails, the forces restrained by the joint will be released to impact other elements of the building. This redistribution of forces can cause the sudden failure of other structural framing in a similar manner to the way the separation of ceiling framing and cracking of exterior wall masonry were related in 1989. While it is highly unlikely that the building will collapse, a sudden large force redistribution can cause glass shattering, localized support failures of stairs, doors, ceiling systems, and other elements of the building that could injure or cause panic to building occupants. If the support for roof framing is lost along the south edge of the administrative wing, the roof loads may be transferred to the second floor framing. This additional load could overstress the support of the second floor framing and lead to a partial collapse of the second floor over the south office of the administrative wing. (See Photos (E) on Sheet EX14, (F) on Sheet EX11, and (C) on Sheet IN27 in Appendix C.)

The public restrooms in the administrative wing drained to a 4-inch sewer line that used to flow to the west under the building footings. This sewer was repaired in 1967. The repair included a sleeve in the foundation wall providing a 2-inch tolerance for differential movement between the building and the pipe. In 1990, the sewer was excavated and inspected. The sewer was found to be broken and was leaking large amounts of water to the underlying soils. The pipe may have allowed surrounding soils to collapse into the sewer and be flushed away. After the collapse of this pipe was discovered, the sewer pipe was rerouted to a manhole outside the south wall of the building. The park staff replaced the sewer line with a new 4” plastic line that is sleeved with a larger pipe for its complete length from the building to the manhole. This arrangement is intended to allow maintenance staff to inspect the manhole for seepage from the outer pipe which would indicate leaks in the sewer pipe.

Surrounding Site Conditions

The hillside to the south of the Quarry Visitor Center drains surface water toward the south wall of the building. The water is intercepted by an unpaved maintenance access road which runs along the exterior face of the south wall of the building. A perforated pipe buried in a shallow trench was installed below the center of the access road to help intercept surface water and drain it both east and west of the building site. In 1988, this horizontal drain was found to be connected to the storm drain system that the roof drains were discharging into. This perforated pipe probably discharged roof drainage into the subsoils along the south wall of the building. The fill materials in the trench of this lateral drain may have encouraged surface water to migrate

into the subsurface soils along the south wall of the building.

The north area of the building site was originally graded to drain surface water to the north away from the north wall of the building. The grade immediately adjacent to the north wall currently slopes toward the north building foundation wall. Nominal regrading along the north wall could correct this condition.

Several sinkholes, fed by eroded drainage channels, were found north of the building. These holes collect surface runoff and feed underground cavities. Because the geologic bedding planes incline 65 degrees dipping south under the building, the surface water collected by these sinkholes may be flowing back under the building through porous subterranean strata. Records of groundwater accumulation indicate that the static groundwater elevation is generally 10 to 12 feet above the first floor elevation of the building in the strata north of the building. This results in a hydrostatic pressure on the backside of the quarry face in excess of 600,000 pounds. Water occasionally bleeds through the face of the quarry. (See Photos (E) and (F) on Sheet EX21 in Appendix C.)

Recommendations

The Quarry Visitor Center's differential movement and structural distress is caused by the deterioration and expansion of the moisture-sensitive geologic strata under the building. Three basic approaches to adapting the building to this site geology are available. The first approach is to stabilize the expansive strata. The second approach is to support the building on a foundation which is independent of the underlying expansive materials. The third approach is to modify the building and foundation to accommodate movements without causing distress or reducing stability.

Stabilizing the existing strata is unlikely. Although there have been developments in chemical grouts in recent years, the possibility of stabilizing the existing strata by injecting chemical grouts or stabilizers is very unlikely. Control of water and moisture at the building site is essential to minimizing the deterioration of the geologic strata and slowing the rate of expansion in the underlying materials. Years of expensive attempts to control the deterioration of the underlying rock/soil have not ended the building's continuing deterioration. While addition effort to keep water from infiltrating the soils at the site is required, it will not eliminate the expansion of the decomposing strata. Groundwater from natural sources is sufficient to continue the decomposing process in the underlying geology.

Modifying the building to accommodate movements of the underlying geology would require extensive changes to the foundation systems and would impact the original architecture. Because of the historic significance and landmark status of this building, these changes would likely be unacceptable. Therefore, changing the foundation support system to one that is independent of the underlying expansive materials is probably the most viable approach to providing long-term stability for the building.

The key to stabilizing the building is to find a method of preventing the swelling clay shales under the south half of the building from heaving the foundations and floor slabs. The

foundations must be supported on deep seated piers and isolated from the swelling upper soils. The floor slabs should be structurally supported by framing that is supported on the wall foundations.

The amount of stress carried by non-structural secondary building systems is impossible to determine. As was demonstrated by the ceiling buckling phenomenon of the cylindrical administrative wing, when an inadvertently loaded secondary building system fails, it transfers the load it was carrying into another resisting mechanism. The additional load may overstress the new mechanism and cause it to fail. This can lead to a domino effect of load transfers until a mechanism capable of resisting the newly acquired loads stops the progression—or until a structural failure occurs.

The building cannot tolerate much additional distortion without compromising public safety. The rate of disintegration is increasing. Therefore, major rehabilitation and stabilization work is necessary to repair the building and accommodate it to the continued deterioration of the underlying geologic strata. The stabilization should be started as soon as possible.

Mechanical Condition Assessment

Unless otherwise noted, the mechanical system information described below was obtained from the original construction drawings and may not reflect as-constructed conditions.

"Ductwork" – includes ducts, fittings, housings, dampers, supports, insulation and accessories comprising a system.

"Piping" – includes pipe, fittings, valves, supports, insulation and accessories comprising a system.

Building Envelope:

- Exhibit Shelter:

  The southern portion of the lower visitor gallery - room (102) - floor is 4-inch thick concrete slab over 1-inch sand over 6-inches imported fill. The northern portion of the lower visitor gallery has an earth floor. A concrete slab floor was added over approximately one-quarter of this earth floor in approximately 1984 to allow visitor access to the quarry face, and does not likely have insulation below. Park staff reported that this slab was replaced in 1986.

  Historical documents indicate that the eastern portion of the original lower visitor gallery concrete floor heaved and cracked in 1962 and again in 1966 due to swelling of the expansive soils.[38] Park personnel reported that the central and western portion of this floor is stable and has not been repaired. The lower visitor gallery floor is currently in fair condition with no noticeable cracks beneath the carpet.

  The east, west, and north walls are approximately 7-inch thick concrete at the base with steel framing surrounding single-pane glass panels above. Many of the windows in the east wall have been replaced with plexi-glass, and others are covered with tinted plastic safety film.[39] There are numerous openings in the walls between the concrete foundation walls and the steel framing, most notably 1 to 2-inch gaps repaired with metal panels and expanding foam on the east wall.

  The lower portion of the south wall, which separates the exhibit shelter from the south wing, is 2x4 wood frame construction with 4-inch rock wool insulation and ½-inch gypsum board sheathing on each side. The upper portion of this wall above the elevated gallery has a 4-foot high uninsulated pipe chase at the base with steel framing surrounding single-pane glass panels above. A few of the south windows have been replaced with plexi-glass, and others are covered with tinted plastic safety film. The

[38] 05/14/62 - Memorandum – Inspection of damage and proposed repairs, Supervising Structural Engineer, RMR and 12/13/66 - Memorandum - "…Proposed Emergency Repairs, Quarry Visitor Center…, Chief of Maintenance, MWR.

[39] 11/07/94 - Report – "Quarry Visitor Center Work 1994". Unknown author, Dinosaur National Monument.

safety film is severely clouded where it is installed on the exterior of the glass, most likely due to ultraviolet degradation.

Exhibit shelter glazing is not specified on the original construction drawings and construction specifications were not located. Park personnel reported that the windows in the north wall are tempered and tinted, and most of the other windows appear to be either single pane clear glass or plexi-glass. Local newspaper accounts at the time of construction reported the exhibit shelter had "glass walls with customized sun filters" and a construction progress report noted "dusklite glass" panel walls that would "eliminate the reflection of the summer sun from the adjacent hills."[40]

The north and south exhibit shelter walls each contain a row of operable windows that comprise most of the length of the glazing and were installed during the original construction. The east and west walls contain smaller sections of operable windows that were installed in 1967.[41] Most of these operable windows do not seal properly. A significant portion cannot be opened due to distorted frames caused by movement of the structure. Each operable window has a rack and pinion mounted on a common shaft that opens and closes multiple windows. The shaft is rotated by a gearbox connected to a chain-pulley that is manually actuated from below by a continuous chain. Windows that still operate are kept open all summer and closed all winter to moderate the internal temperature. Park staff reported that roughly half the windows break when they are opened each spring and closed each fall due to building movement between seasons. Park staff indicated that they would prefer to open and close the windows more frequently, but it is impractical do so because of the glass breakage that occurs.

The lunch room's (101) west wall is comprised of 8-inch thick concrete masonry units with voids filled. Gypsum board was added to the interior of this wall when the original tool room was converted into a lunch room in 1997. It appears that 2x4 wood framing is located behind the gypsum board. Park staff reported that it is unknown if insulation was installed in the new frame wall. There are numerous cracks visible on the exterior of the west wall, some as large as 1-inch wide.

The exhibit shelter roof is 2x6 tongue-and-groove wood decking with 0.60-inch EPDM membrane full adhered roofing material. Park staff reported that the roof was insulated with ½-inch hard board fiber when the roofing material was replaced in 1997.

Park and concessionaire employees reported uncomfortable conditions year-round in all spaces, with noticeable drafts during the heating season. Infiltration is excessive due to windows that cannot be sealed and cracks in the walls, all the result of significant building movement.

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[40] "Rising Visitor Center Revives Dinosaur Era," Vernal Express, September 26, 1957 and "Progress Report of Mission 66 at Dinosaur National Monument," National Park Service, March 7, 1958. Cited in Allaback, Mission 66 Visitor Centers, 55.

[41] 09/06/67 - Repairs to Visitor Center, Quarry Site, Construction Drawings, NM-DIN/3330-A, Revised 04/68, D&C, SSC, NPS.

- South Wing:

  The floor in the south wing is 4-inch thick concrete slab over 1-inch sand over membrane over 6-inches drain rock. The south wing concrete floor is currently uplifted by as much as 12-inches and has numerous exposed ledges and cracks, some as wide as ¾-inch. Concrete patches indicate that large portions of the mechanical room (103) floor have been replaced.

  The south wall is 8-inch thick concrete masonry units (voids not filled) with 4-inch rock wool insulation between 2x4 wood studs with ½-inch gypsum board sheathing on the interior face. Steel framed operable windows are located at the top of the south wall except in the mechanical room (103) and original dark room (109). Many of these windows cannot be opened due to distorted frames caused by movement of the structure, and most do not seal properly. A sixteen-inch square louvered vent is located at window level in the south wall of the mechanical room (103) and is currently blocked with a plywood cover inside the room. There are numerous cracks visible on the exterior of the south wall, some as large as ¾-inch wide.

  The west wall is 8-inch thick concrete masonry units with voids filled and has a severely racked oversized steel door frame containing a standard size non-louvered single leaf steel door with wood frame filling between it and the original door opening. The door does not seal properly due to movement of the structure, having gaps as large as ¼-inch between the new frame and door. Park maintenance personnel reported that they constantly adjust the hinges and thresholds for proper door operation. The original oversized mechanical room exterior door was double leaf and had adjustable louvers, and was replaced at an undetermined time before 1987. There are numerous cracks in the west wall, some as large as 1-inch wide, and a few that can literally be seen through.

  The north wall of the south wing, which separates the south wing from the exhibit shelter, is 2x4 wood frame construction with 4-inch rock wool insulation and ½-inch gypsum board sheathing on each side.

  The east wall, which separates the south wing from the admin wing, is 8-inch thick concrete masonry units (voids not filled) with 2x4 wood frame construction, no insulation, and ½-inch gypsum board sheathing on each side.

  The south wing roof is 3x6 tongue-and-groove wood decking, 2-inches of foam board insulation with composition roofing material. A secondary roof was added on top of the original roof in 1997 to re-establish positive drainage to the south. Park staff reported that the secondary roof consists of 2x4 wood framing, ½-inch plywood sheathing, ½-inch hard board fiber and 0.60-inch EPDM membrane full adhered roofing material.

  Park and concessionaire employees reported uncomfortable conditions year-round in all spaces, with noticeable drafts during the heating season. Infiltration is excessive due to windows that cannot be sealed and cracks in the walls, all the result of significant building movement.

- Admin Wing:

  The floor is 4-inch thick concrete slab over 1-inch sand over membrane over 6-inches drain rock. Historical documents indicate that the concrete floor heaved, cracked and has been repaired numerous times due to leaking water and waste piping, and swelling expansive soils.[42] The lower lobby (112) floor is currently in poor condition with noticeable cracks and ridges beneath the carpet.

  The walls are 8-inch reinforced concrete masonry units with 4-inch rock wool insulation between 2x4 studs with ½-inch gypsum board sheathing on the interior face. Steel framed operable windows with fixed lites above are located in the walls as shown on the drawings. Many of these windows cannot be opened due to distortion of the frames caused by movement of the structure, and most do not seal properly. The windows are shown as ½-inch thermopane insulating glass on the original construction drawings, but this was not field verified. Park staff reported that some of the windows are plexi-glass, some are ¼-inch single pane, and the others are thermopane. Small louvers, currently covered with plywood, are located below windows at each fan coil unit on both levels. Louvers are either at or partially below grade on the lower level south and west elevations due to the grade being raised south of the structure to improve drainage. There are numerous cracks visible on the exterior walls, some as large as ¾-inch wide.

  Double leaf aluminum framed doors with full height single pane glass are located in both the upper and lower lobbies (112 and 202) on the east elevation. None of these doors seal properly due to movement of the structure, having gaps as large as ½ to ¾-inch width between the frame and door. Park maintenance personnel reported that they constantly adjust the hinges and thresholds for proper door operation.

  The admin wing roof is 2x6 tongue-and-groove wood decking. It originally had 2-inches of foam board insulation with composition roofing material, but park staff reported that it currently has 1 to 12-inches of sprayed polyurethane insulation covered with 1 to 1½-inches of rigid foam and 0.60-inch EPDM membrane full adhered roofing material.

  Park and concessionaire employees reported uncomfortable conditions year-round in all spaces, with noticeable drafts during the heating season. Infiltration is excessive due to windows that cannot be sealed and cracks in the walls, all the result of significant building movement.

HVAC System:

[42] 02/15/66 - Memorandum – Emergency Repairs of Sub-floor Waterlines…, Chief of Area Services, Western Office Design and Construction, NPS and 09/06/67 - Repairs to Visitor Center, Quarry Site, Construction Drawings, NM-DIN/3330-A, Revised 04/68, D&C, SSC, NPS and 03/25/68 - Change Order No. 1 to Contract No. 14-10-7-971-116 dated 01/22-68, Construction of Repairs to Visitor Center, Chief Contract Administration and Construction, SSC, NPS and 03/21/83 - Memorandum - Building inspection to evaluate damage caused by recent shifting, General Engineer, Branch of Buildings and Utilities., RMR.

The original HVAC system consisted of a fuel oil fired boiler and a chiller located in the mechanical room (103), and a cooling tower located on a concrete pad just west of the mechanical room. The exhibit gallery was heated by hydronic piping cast in both upper and lower visitor gallery (102 and 201) floor slabs. The south and admin wings were heated and cooled by console type fan coil units located along the walls.

The original oil fired boiler was replaced with two Weil-McLain 552 MBH size ABL-876W oil fired boilers in late 1981 or early 1982 (Weil-McLain determined that both boilers were shipped from their factory in October 1981 based on CP numbers found on the boiler nameplates). Both boilers appear to be in fair condition; however the internal fireboxes and heat exchangers were not inspected. Each boiler is shimmed with small metal plates beneath its north edge due to the significant floor slope. Park staff reported that both boilers were converted to propane, and the underground fuel oil tank west of the mechanical room and associated piping was removed in approximately 1989. The change from fuel oil to propane was made because the fuel oil tank needed to be replaced to comply with the newly imposed underground storage tank regulations.

A 12,000 gallon propane tank is located roughly 240 feet west of the structure and is in good condition. Park staff reported that the large propane tank was selected to allow bulk-rate purchase of propane, and they only have to fill the tank once every two years. A second-stage propane regulator is situated on the west elevation of the south wing just north of the door and is in poor condition. Large rocks have been positioned just south of the regulator to protect it from rock falls originating on the steep slope south of the service drive. The location of the regulator may not meet NFPA 58 because snow may block its discharge due to its close proximity to the ground. A high pressure propane line runs underground between the first-stage regulator at the tank and the second-stage regulator at the structure. Park staff reported this line is yellow plastic, and is most likely made of PE 2406 medium density polyethylene. Exposed black iron piping runs from the second-stage regulator through the wood framing within the large historic door frame, then above the floor between the two boilers. The piping divides into two branches then connects to a Honeywell Fluid Power #V4055A-1098-3 gas valve and a Gordon-Piatt #AF777300 power gas burner located on the east side each boiler. The gas valves and power gas burners appear to be in good condition.

Each boiler exhausts horizontally to the west and contains a Fields Control Co. type M+MG2 barometric draft control. The exhausts are then manifolded together, discharging vertically through a ¼-horsepower Tjernlund Products model IL induced draft fan, then up through the roof. The exhaust stack is 11-inch diameter steel painted black, and projects vertically approximately twenty-four feet above the south wing roof to an approximate 8-inch by thirty-degree offset, then vertical again for another 4-feet past the exhibit shelter's winged roof, terminating with a square cap on top. The stack has four guy-wires attached approximately two-thirds the way up, with two anchored to the top of the pipe chase at the base of the upper visitor gallery windows, one anchored to the south edge of the south wing roof, and one anchored to the west side of the south wing roof. The original construction drawings depict a much smaller exhaust stack,

terminating only 2-feet above the south wing roof. It is not documented when the taller stack was added, and neither stack appears on known historic construction photos. The tall stack was probably added to keep soot from tarnishing the underside of the exhibit shelter roof and may be a character defining feature.

Boiler hot water supply and return piping is noticeably skewed and evidence of repair is visible in numerous places due to movement of the building. Misaligned flanged pipe joints contain extra thick gaskets to properly seal in many places throughout the system. The hot water circulation pump for the fan coil units in the south and admin wings is located in the southeast corner of the mechanical room and is anchored to the sloping floor on a tapered mounting base. The pump is a Bell and Gossett 1531 model 2½ AC 6½ with a 2-horsepower, 3 phase, 1725 rpm direct drive motor. The pump and motor are in good condition and there is an identical spare pump and motor sitting on the shelves near the south boiler. Thick calcium deposits are present on a main return valve above the north boiler and the main supply valve above the circulation pump, indicating both valves have been leaking for an extended period of time. Two large expansion tanks are suspended from the ceiling just south of the boilers and appear to be functional. All supply and return pipes are insulated with asbestos, except those adjacent to the boiler and the circulation pump, and are in poor condition due to building movement.

Five primary residential evaporative "swamp" coolers and two small residential window air conditioners were added to the south and admin wings at an undocumented time, most likely in the early 1980s. A former park facility manager indicated that this change was made to reduce electrical power use, and estimated the cooling cost dropped from roughly $700 per month when operating the chiller and cooling tower system to around $200 per month for the evaporative cooler and window air conditioner system. According to the original electrical drawings the chiller had a 20-horsepower refrigeration compressor, so these estimates could be viable. The chiller and cooling tower were abandoned after the evaporative coolers and window air conditioners were installed, and were removed in 1991 according to current park personnel.

The primary evaporative coolers serve the laboratory (104), lower lobby (112), office (114), upper lobby (202), and office (204). All units are small residential units; roughly 34-inches square by 36-inches high, and have custom-made tapered duct transitions that connect to existing window openings. The units that serve the laboratory and upper lobby are located on the south wing roof on tapered wooden frames that do not appear to be securely attached to the roof, and are prominent features seen by visitors from the upper visitor gallery (201). The unit that serves office (204) appears to be smaller than the others. This unit is supported by a steel frame anchored to the admin wing's CMU walls and is also seen by visitors from the upper visitor gallery. The unit that serves the lower lobby (112) is supported by a steel frame attached to the steel window framing just north of the main entrance door and is a prominent feature at this entrance. The unit that serves office (114) is located on masonry blocks on the ground south of the admin wing and is seen by visitors from the entry ramp. The primary evaporative coolers are all painted tan except the smaller unit that serves office (204) is factory finish grey. All units are non-historic and create a significant negative visual impact.

Water for the primary evaporative coolers is supplied via small diameter copper tubing that is run exposed along the exterior of the building. To prevent freezing, these water pipes must be filled after the last frost of the spring, and blown out before the first freeze in the fall. This does not allow for mechanical cooling of any kind during the majority of either shoulder season. Employees reported uncomfortable interior conditions while the evaporative coolers are non-operational during these periods.

Controls for the primary evaporative cooler in the laboratory (104) consist of a thermostat located near the west laboratory door with an on/off switch to force the unit off. Controls for the other four primary evaporative coolers are located on the interior walls adjacent to the units and consist of on/off switches with no thermostatic control.

An Emerson "Quiet Cool" residential type window air conditioner is located in the southeast window of the paleontologist's office (110). A Fedders residential type window air conditioner is located in the southwest window of the library/conference room (111). Both units are in poor condition and appear to be left in place year-round. The portions of the window openings not occupied by the units are blocked off with rigid blue foam insulation and sealed with expanding spray foam insulation. Each unit is controlled by an on/off wall switch located on the north wall of each room. Individual unit controls (high cool, low cool, fan speed) are inaccessible without the use of a ladder.

The hydronic heating systems in the upper and lower visitor gallery floor slabs were abandoned at an undocumented time prior to 1967.[43] The systems were abandoned for undocumented reasons, but based on historic memorandums the lower gallery floor slab was "damaged" in 1962[44] and "buckled and fractured" in 1966.[45] It is reasonable to assume that the lower gallery hydronic piping leaked when the floor slab heaved, and the hydronic system was abandoned to prevent additional water from leaking into the soil. The upper gallery hydronic system was most likely abandoned when the upper floor slab began to drop due to uplifting of the south wing. The north edge of the upper floor slab is currently 8 to 10-inches below its original level.

The hydronic piping in the lower visitor gallery (102) floor slab was located directly on grade with no insulation below and 4-inches of concrete above. Three balancing valves were located in small vaults cast in the slab near columns B3, B5 and B8, with valve access panels in the floor. Two pipe expansion joints were cast in the slab at the center of the structure between column lines 5 and 6. The extent of lower visitor gallery floor slab replacement is undocumented, therefore it is unknown how much hydronic piping remains in the slab. The main supply and return piping for the lower slab's hydronic system was routed down through the northwest corner of the mechanical room (103)

[43] 09/06/67 - Repairs to Visitor Center, Quarry Site, Construction Drawings, NM-DIN/3330-A, Revised 04/68, D&C, SSC, NPS.
[44] 05/14/62 - Memorandum – Inspection of damage and proposed repairs, Supervising Structural Engineer, RMR.
[45] 12/13/66 - Memorandum - "…Proposed Emergency Repairs, Quarry Visitor Center…, Chief of Maintenance, MWR.

floor, then ran north beneath the lower slab. The hydronic supply and return piping in the mechanical room was removed at an undocumented time.

The hydronic piping in the upper visitor gallery (201) floor slab was located directly on the upper gallery's steel ribbed forms with 3-inches of concrete above. Historical documentations suggest that the upper slab is original and the park staff concurs, therefore the hydronic piping is most likely still in place. The main supply and return piping for the upper slab's hydronic system was routed up through the northwest corner of the mechanical room into the pipe chase above the north edge of the south wing roof. From the pipe chase, the supply and return piping was run down through the south wing's 3-inch wood deck roof and north into the upper gallery floor slab at five locations. Three balancing valves were located in the pipe chase near columns B1, B3 and B5, with valve access panels in the south wall of the upper gallery. Two pipe expansion joints were located in the pipe chase at the center of the structure between columns B5 and B6. The hydronic supply and return piping in the mechanical room was removed at an undocumented time, but is most likely still in place in the pipe chase.

Currently high volume industrial pedestal fans are used to circulate air in the lower visitor gallery (102) during the cooling season. These fans are loud and have to be turned off during ranger talks. No heat of any kind is provided in the exhibit shelter during the heating season, including portable heaters for employee comfort at the information counter in the lower gallery. Park staff reported wide temperature fluctuations in the exhibit shelter, with highs near 90-degrees F in the cooling season and below 30-degrees F in the heating season.

Nine console type fan coil units are built into a pipe chase located below bookshelves along the south wall in the south wing, and twelve are exposed along the walls in the admin wing. The units in the admin wing project out from the circular walls roughly 12-inches and vary in length from 34-inches to 53-inches, taking up valuable floor space. All fan coil units are currently used only for heating, but they were also used for cooling before evaporative coolers replaced the chiller and cooling tower. All of the units appear to be original and are Dunham-Bush CRV Conditioners except for a new console unit installed in the employee restroom (107) in 2002. Four of the units were removed from the admin wing at an undocumented time: two from office (114); one from upper lobby (202); and one from office (204). Park staff reported that none of the five fan coil units that were removed were salvaged.

A fan coil unit was originally located in the north portion of the dark room (109, now part of paleontologist office 110). The unit was possibly ceiling mounted, but is no longer present.

Hot water supply and return piping for the fan coil units is located in the pipe chase in the south wing, and in the wall cavities and joist space between floors in the admin wing, and is insulated with asbestos. The supply and return piping is a two-pipe system, which can have either hot or chilled water in the lines at any one time, but not both. The changeover time from heating to cooling is inherently long with two-pipe systems because the heat in

the system must be expelled before water can be introduced into the chiller, otherwise chiller damage will occur. The shoulder seasons were most likely very uncomfortable due to the heat required for the cold mornings and the hot afternoons with only heat available until changeover could occur. This long changeover time could have partially contributed to abandonment of the original cooling system.

The fan coil units discharged condensate when they were used for cooling and the condensate drain collection pans are still full of rust. Condensate drain lines are not shown on the original construction drawings and it is unknown how condensate was drained from the units. If condensate was drained beneath the foundations it might have contributed significantly to the swelling of the expansive soils beneath the structure and to the abandonment of the original cooling system.

Controls for the fan coil units consist of a manual fan control switch on each unit and a single thermostat in each wing. The south wing thermostat is located across from the janitor's closet (108) on the north side of the corridor (105) wall, 70-inches above the finish floor. The admin wing thermostat is located beneath the stairs on the southeast wall, 60-inches above the finish floor. The fan control switches are built-in to the north face of the pipe chase adjacent to each fan coil unit in the south wing and are accessible through a hatch in the top of each unit's housing in the admin wing.

A 6-feet long electric baseboard heater is centered along the west wall in the lunch room (101).

A lightweight ceiling fan with three blades is located in the eastern half of the library/conference room (111) and is controlled by a 3-way (high/low/off) switch on the north wall, just west of the door.

None of the three restrooms (107, 207 and 208) have exhaust fans.

Park and concessionaire employees working in the structure reported uncomfortable working conditions year-round in all spaces. Employees cite non-uniform temperature control in the heating season due to a single thermostat in each wing used to control all the fan coil units in that particular wing, and drafts due to infiltration through cracks in the walls and windows that cannot be sealed. Employees cite non-uniform temperature control in the cooling season due to the evaporative coolers and window air conditioners being either on or off, and unusable spaces due to the noise and high air volume discharged by the evaporative coolers. The structure's current HVAC system consists of a patchwork of components that has been assembled over the years in response to failing systems resulting mainly from building movement.

A dust collection system, air filtration system and make-up air system are located in the laboratory (104) and were installed in 1996 according to park personnel. The dust collection system is used to evacuate the dust generated from high speed pneumatic tools that remove rock from the fossils. The system consists of eight 6-inch diameter slide-gated duct openings near the ceiling, 6-inch diameter flex hose, ducting, and an exhaust

fan located outside. Five flex hoses currently hang from five slide-gated openings, leaving three slide-gated openings without flex hose. The collection end of the flex hoses are positioned with ropes suspended from the ceiling. Slide gates are 9-feet above the floor and can not be accessed without a ladder. Employees reported they typically block the ends of unused flex hose with the floor rather than closing the slide gates. The ducting has three spiral wound branches with two pick-up points each and two pick-up points beneath the main plenum. The ducting is hung directly from the ceiling, routed out a window, down the exterior wall with a flex connection, then into the fan inlet. The fan is a Greenheck model #SWB-30-7-CW-TH-X centrifugal backward inclined type with ¾-horsepower belt drive motor, and is mounted on spring vibration isolators that are anchored into a concrete slab. The fan discharges through a backdraft damper to atmosphere, and does not have a dust collector or filter of any kind, which may violate applicable air emission codes and standards. A park employee reported that the dust collection system performs satisfactorily with little dust escaping into the room, and with little need for the air filtration system. The employee also noted that the system was tested by an independent laboratory and was found to remove dust to The National Institute for Occupational Safety and Health (NIOSH) standards.

The air filtration system is used to filter fine dust floating free in the air that was not captured by the dust collection system. The system consists of long rectangular ducting, two intake grilles, high efficiency filter, in-line fan, and two exhaust grilles. The system pulls air in from the two intake grilles located in the west portion of the lab, through the filter and in-line fan, then discharges it out the two exhaust grilles in the east end of the lab. The filter is an AAF International Access Air Polyseal model. The fan is a Greenheck model #SQ-160B centrifugal inline type with ¾-horsepower direct drive motor, hung with spring vibration isolators. The entire air filtration system is hung from unistrut clamped to the historic steel roof beams.

The make-up air system is used to replenish air exhausted by the dust collection system and is operated only when the dust collection system is operating. The make-up air system consists of an evaporative cooler, propane duct furnace, and ducting with a flexible connection located on the south wing roof, and a supply box with two adjustable grilles hung beneath the lab's ceiling. The evaporative cooler is 42-inches square by 56-inches high, and is substantially larger than the five primary evaporative coolers. Park staff reported that water has never been connected to this evaporative cooler, and that it has never been used for cooling. Make-up air for cooling is provided by the lab's primary evaporative cooler on the south edge of the roof that discharges air through one of the lab's window. The fan on the larger make-up air evaporative cooler is used for duct furnace supply air in the heating season.

The duct furnace is a Modine model #WDG350SFM with 252 MBH output capacity at 2000 to 4500 feet elevation. The furnace has a 13-inch stack that terminates 9½-feet above the roof with a cylindrical cap. Propane is supplied to the duct furnace through painted 1-inch black iron piping run exposed on the south wing roof. The propane piping is run exposed over the west edge of the roof and connects to the boiler propane line just

above the second stage regulator. An American Meter model AL-120 gas meter is located on the north side of the duct furnace.

All make-up air system components exposed on the south wing roof do not appear to be securely attached to the roof. These components are painted the same tan as the majority of the primary evaporative coolers, and are prominent features seen by visitors from the upper visitor gallery (201). The system is non-historic and creates a significant negative visual impact.

All make-up air system components exposed on the south wing roof do not appear to be securely attached to the roof. They also appear to be painted the same tan as the majority of the primary evaporative coolers. These components are non-historic prominent features seen by visitors from the upper visitor gallery (201) and create a significant negative visual impact.

An enclosed laboratory fume hood is located in the southwest corner of the laboratory (104) and has an internal exhaust fan connected to vent pipe that discharges vertically up through the roof. The exhaust stack is 9-inch diameter steel painted tan, and projects vertically approximately 6-feet above the south wing roof, terminating with a round, slightly conical cap on top.

A small industrial fan is hung from the historic steel roof beams in the southwest corner of the laboratory (104) and was used to exhaust a forge. Park staff reported that the forge was removed in approximately 1987 and is currently stored in the compressor shed west of the exhibit shelter. The fan is a NYB Junior model #75A-T4148 with direct drive motor, and has no ducting connected to its inlet flange. The fan's discharge penetrates the ceiling, but the stack and roof penetration are not visible on the roof above, and were most likely removed and covered when the new roof was added in 1997.

Sheet metal for the historic dark room vent is attached to the ceiling in the southwest corner of the paleontologist office (110). Park staff reported that the darkroom (105) was removed in 1987 to enlarge the office. The sheet metal penetrates the ceiling, but the stack and roof penetration are not visible on the roof above, and were most likely removed and covered when the new roof was added.

A chemical storage cabinet is located in the northwest corner of the mechanical room (103) and has a 4-inch painted PVC vent stack that penetrates the west exterior wall approximately 82-inches above the floor. The stack then projects vertically and terminates approximately 10-feet above the ground with a round, slightly conical cap on top.

Park staff reported that they do not currently have peak/off-peak power rates.

Plumbing:

- General:

  The plumbing system consists of domestic hot and cold water supply piping, underground waste lines, vent piping, and storm drain piping from the roof drains. Numerous changes have been made to the plumbing system over the years due to pipes failing from the corrosive soil and from significant building movement.

  The exhibit shelter was built above an existing 8-inch cast iron water main that runs along the base of the quarry wall and extends east of the structure. The 8-inch main originates at two underground 50,000 gallon water tanks located northwest across the valley and runs underground from the tanks down the hill, beneath the road, up the quarry hill and through the flat area west of the structure. Municipal water is pumped from the maintenance facility up to the tanks. According to park personnel, the cast iron main was replaced between the tanks and the visitor center with a "Blue Brute" PVC main in 1999 because it required constant repair. The section between the tanks and the road, where the maintenance facility/employee housing line branches off, was replaced with an 8-inch line. The remaining section from the road up the hill to the visitor center was replaced with a 6-inch line.

  In the early 1980s, several breaks occurred in the 8-inch water main at the base of the quarry wall in the exhibit shelter. These pipe breaks saturated the gravel bedding below the concrete floor and quickly spread to all areas below the floor, causing the expansive soil to swell and considerable movement and damage to the building. The amount of water released was estimated at the time at 400,000 gallons. To remedy this, the 8-inch main was placed in a new underground insulated concrete pipe chase.[46]

  Original construction for the visitor center consisted of three underground branch water lines that were tapped into the existing 8-inch water main to serve facilities in the south and admin wings. Each branch line was run in a 6-inch asbestos cement sewer pipe conduit. The 2½-inch branch line that served all domestic fixtures in both wings as well as make-up water for the HVAC system was installed parallel to and just east of column line 9 and rose through the floor slab near column A9. The line continued up within the wall cavity and entered the space below the joists between the first and second floors in the admin wing, then was routed either up or down within the wall cavities to serve the domestic fixtures. This line also branched off near column A9 into the pipe chase at the base of the south wing's south wall, running west to serve the domestic fixtures and the HVAC system in the south wing. The other branch lines that tapped into the existing 8-inch water main will be described under the "Fire Protection" section below.

  A new 6-inch PVC line was connected to the original 8-inch cast iron main roughly 10-feet west of the structure in 1991.[47] The remaining 8-inch main running along the base of the quarry wall was capped and abandoned along with all the underground branch lines within the structure and the fire hydrant east of the structure. The new 6-inch PVC main

[46] 03/21/83 - Memorandum - Building inspection to evaluate damage caused by recent shifting, General Engineer, Branch of Buildings and Utilities., RMR.
[47] 07/02/91 - "Water/Sewer Reconstruction – Quarry Visitor Center", Construction Drawings, 122/80045, RMR.

is single-wall and runs south through a new concrete vault, then east on the south side of the south wing to the relocated fire hydrant south of the entry ramp. Park staff reported that link-seals are located between the 6-inch pipe and the vault wall penetrations, although water in the vault at the time of the inspection prevented this from being verified.

A new 4-inch branch with gate valve and pressure relief valve ties into the new 6-inch main in the vault. The 4-inch branch passes under the exhibit shelter's foundation and then rises vertically through the floor into the lunch room (101) along the north wall. This branch is encased in a flexible 6-inch ABS corrugated pipe that slopes back to the vault for leak containment and manual leak detection. Park staff reported that this flexible system with leak detection capability is working well.

A new 1½-inch domestic supply line branches off of the 4-inch riser in the lunch room immediately above the floor and is routed along the ceiling to the southeast corner of the mechanical room. There it connects to the original 1½-inch domestic cold water line that runs through the pipe chase to serve the south wing and admin wing. The original underground branch that served these wings from near column A9 is shown capped and abandoned on the 1991 drawings.[48]

A water meter is not installed in the structure, but park staff reported that they use a portable meter to periodically check for leaks during periods of no water use.

In early August 2003 the concrete vault west of the visitor center had 26-inches of water in it, approximately level with the bottom of the 6-inch ABS containment pipe. Park staff reported that a ½-inch ball valve on the pressure relief valve was split and has since been repaired, and that the water is currently 1 to 2-inches deep in the vault and has not increased in depth since the valve was repaired. The concrete vault is not currently insulated in accordance with the 1991 drawings, which may have caused the valve to freeze and leak. This may be an ongoing problem because a 1993 memorandum reported that water was present in this vault.[49]

- Exhibit Shelter:

  Original exhibit shelter plumbing fixtures and components consisted of the 8-inch cast iron water main at the base of the quarry wall described above, roof drains, storm drain lines, and service sink and utility trench in the tool room (now lunch room 101).

  The storm drain system consisted of six roof drains located in the shelter roof trough along column line B with 4-inch storm drain risers running exposed down the columns. The risers located adjacent to columns B3, B5, B6 and B8 entered the pipe chase above the north edge of the south wing's roof, were routed beneath the south wing roof sheathing, then down within the south wall cavity, and discharged on splash blocks located just south of the south wing. The east and west storm drain risers at columns B1

[48] Ibid.
[49] 08/23/93 - Memorandum – Trip Report, Quarry VC Familiarization. T. Windle, CE, RMR.

and B10 continued down the columns and discharged on splash blocks just east and west of the exhibit shelter.

In 1962, the six exhibit shelter roof drain lines were piped together and routed to the east into the 4-inch riser adjacent to column B10, then discharged into a new underground French drain system located east of the structure.[50] In 1966 the single 4-inch roof drain riser was rerouted from column B10 to column B8, into the pipe chase, east to column B9, beneath the south wing roof sheathing, out and down the south wall near column A9, then into a new underground galvanized steel storm drain pipe located beneath the service drive.[51] This pipe also intercepted and collected water from the existing French drains at several locations, allowing water to drain into the soil near the building.[52] As late as 1989 the structure's roof drain system continued to discharge into the site's French drain system, which undoubtedly accelerated the expansive soil problem.[53]

The exhibit shelter roof drain line is still run exposed outside the south wall near column A9, then underground. The riser has a 3-inch gap covered with a rubber sleeve attached with hose clamps to allow for building movement. Park staff reported that the underground galvanized steel storm drain pipe failed approximately 10-years ago so the roof drain line was rerouted into the adjacent sanitary sewer line, which discharges into an NPS sewage treatment plant located east of the maintenance area at the base of the hill. Park staff indicated that the sewage treatment plant is oversized and is not overloaded with the roof storm drainage; however this practice is prohibited by the plumbing code when the sewer system is intended for sanitary drainage only.

Park staff reported that the exhibit shelter roof drain system used to freeze causing water to run off the east and west edges of the roof, but this has not occurred since park maintenance added crickets to the roof trough between the drains in 1997 when new roofing material was installed. Park staff also reported that the storm drain piping within the exhibit shelter was not damaged by this freezing. It is unknown if water was freezing in the pipes causing the backup, or in the roof drains; and with the relatively mild winters during the last decade it is unknown if the new crickets have completely solved the problem.

A service sink was originally located along the east wall of the tool room (now lunch room 101) with an under-slab 2-inch cast iron waste line connected into the 3-inch main waste line beneath the mechanical room (103). The service sink was removed from the tool room in 1991 and all lines servicing it capped. A stainless steel counter sink without

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[50] 02/14/62 - Memorandum - Damage...Circular Element…Roof, Maintenance Supervisor, Dinosaur NM and 08/16/62 - Visitor Center Plaza Reconstruction, Construction Drawings, NM:DIN/3149C, Western Office Design and Construction, NPS.

[51] 06/24/66 - Repair Buildings – Dinosaur Quarry Area, Construction Drawings, NM-DIN/2046-A, Maintenance Division, Midwest Regional Office, NPS.

[52] 7/6/66 - Report of trip to Dinosaur National Monument, June 1 through June 17. National Park Service, Midwest Region.

[53] 09/26/88 - Memorandum – Park Briefing on Quarry Center Problems…, Chief (SE), General Engineering Section, DSC and 03/07/89 - Memorandum – Briefing for RMR SE on Building Condition, Structural Engineer, DSC.

garbage disposal was installed in the southeast corner of the lunch room (101) when the lunch room was added in 1997. A new PVC waste line for the sink was installed beneath the mechanical room floor and was tied into the 1991 concrete utility vault in the mechanical room. A patched 16-inch wide cut for the sink's waste line is evident in the mechanical room's concrete floor.

A 1-foot wide utility trench with 3/8-inch cover plate ran from the north tool room wall (now lunch room) south into the northern portion of the mechanical room (103), then east roughly 4-feet. The utility trench was not connected to the waste system, was used for an undocumented purpose, and a majority of it no longer exists.

A refrigerator is located in the northeast corner of the lunchroom and does not have a water connection for an icemaker.

A small square access hatch covering a PVC lined ground water test well is located in the lunchroom floor near the south door.

2-inch compressed air piping with hose connection taps for jackhammers runs exposed on the ground just north of the lower visitor gallery (102) floor slab. The piping originates at the compressor building roughly 180-feet west of the structure and runs a few feet above the ground to the building. The piping terminates just east of column line 9, and appears to run beneath the new floor slab poured in the northeast portion of the exhibit shelter. The compressed air system was installed at an undocumented time and does not appear on the original construction drawings, but a similar system is shown on the 8/16/62 drawings routed from the compressor building to the northwest corner of the exhibit shelter. Park staff reported that this compressed air system is no longer used.

A second compressed air system serves the laboratory (104) and originates at a vertical tank mounted two stage air compressor located beneath the stairs at the west end of the lower visitor gallery (102). Piping is run exposed beneath the stairs. The air compressor is a Saylor-Beall model number VT-735-80, serial number 5-42-S93, with a 5-horsepower 3 phase motor. The compressor shipped from the factory in September 1993 according to the manufacture. Park staff reported that this compressed air system is still used to operate pneumatic tools in the lab.

A "relocated drinking fountain" is shown on the 6/24/66 drawings in the southwest corner of the upper visitor gallery (201), but does not appear on the original construction drawings. This drinking fountain was removed at an undocumented time, but park personnel concur that it was located there.

- South Wing:

  Original plumbing fixtures and components in the south wing consisted of the following: domestic hot water storage tank, circulation pump, and return circulation pump in northwest corner of mechanical room (103); water softener and brine tank in southeast corner of mechanical room; two hose bibbs in mechanical room, one in southeast corner,

one just east of center along north wall; two floor drains in mechanical room, one centered in western half of room, one in southeast corner; sink along the south wall of the laboratory (104) between column lines 3 and 4; water closet and lavatory along east wall of staff restroom (107); service sink along the south wall in janitor's closet (108); counter sink on south wall of dark room (109, now part of paleontologist office 110); and counter sink in northwest corner of geologist office (now part of paleontologist office 110).

South wing plumbing fixtures were originally supplied domestic cold water, hot water, and hot water return with lines routed in the pipe chase at the base of the south wing's south wall. Lines branched off into the partition wall cavities from the main lines in the pipe chase for fixtures not located along the south wall.

Cast iron waste lines were originally located beneath the south wing's floor slab and exited to the south through the foundation in two places: one between column lines 3 and 4; the second just west of column line 6. The two waste lines connected to an underground cast iron waste line running east approximately 5-feet south of the south wing which tied into an existing manhole connected to an existing sewer line running beneath the service drive to the southeast. In 1991 all underground cast iron waste lines were either abandoned or replaced with new PVC waste lines. Two concrete utility vaults were also installed at this time along the south wing's south wall, and new manholes and new PVC sanitary sewer line were installed roughly 5-feet south of the utility vaults.

The first vault, located 104-inches from the mechanical room's (103) east wall, is 18 by 36-inch and has a galvanized steel liner and single ¼-inch thick steel cover plate for access and inspection. The second vault, roughly centered beneath the partition wall between the staff restroom (107) and the paleontologist's office (110), is 60 by 96-inches and has a brushed on elastomeric liner, 2x6 floor joists, fixed ¾-inch plywood floor, and a plywood access hatch beneath the counter in the paleontologist's office. A 6-inch PVC containment pipe is located between each utility vault and each manhole with link-seals between the containment pipes and the PVC waste lines on the vault ends, between the containment pipes and the foundation wall penetrations, and between the containment pipes and the manhole wall penetrations. The containment pipes slope to the manholes for leak containment and manual leak detection.

The 1991 waste system is an elaborate engineered solution to allow for building movement due to expansive soils at the site. The utility vaults, exposed PVC waste lines, and exposed link-seals appear to be in good condition. Park staff reported that the system has performed satisfactorily.

Hot water was originally supplied to the domestic hot water storage tank by a separate heat exchanger in the boiler via a circulation pump. The storage tank was replaced by a water heater at an undocumented time for undocumented reasons. A water heater is shown in the northwest corner of mechanical room (same location as the storage tank) on the 7/2/91 drawings, but is no longer in this location. Currently a 40 gallon electric water

heater is sitting on a tapered wooden base in the southeast corner of the mechanical room east of the service sink. Copper piping is routed into the back of the sink to drain the water heater's pressure and temperature relief valve. The water heater is an A.O. Smith model EES 40 917, part #EES-40-F202172000, serial #GB98-4061145-917, with 4500 watt upper and lower elements, and appears to be in fair condition. The water heater is connected to a time clock in a metal box attached to the wall above the sink. The time clock was not operating.

Domestic hot water piping was installed in the tool room and in the pipe chase along the south wall of the south wing and originally served all the fixtures in the south wing and the admin wing. Currently hot water is available at the lunch room (101) sink, the mechanical room (103) service sink, the laboratory (104) sink, and the lavatory and shower in the staff restroom (107). Hot water is not currently available at any fixtures in the admin wing, including the men's and women's lavatories in the visitor restrooms (207 and 208) and the service sink in the janitor's closet (206). The portion of the hot water piping west of the staff restroom was abandoned at an undocumented time for undocumented reasons, but most likely after the hot water return system was abandoned because it took hot water too long to get to the admin wing.

A domestic hot water return system complete with return circulation pump and hot water return piping was installed in the tool room and in the pipe chase parallel to the hot water piping. The return system originally served all the fixtures in the south wing and the admin wing, but was abandoned at an undocumented time for undocumented reasons.

The water softener and brine tank in southeast corner of mechanical room were both removed at an undocumented time for undocumented reasons.

Of the two original hose bibbs in mechanical room (103) only one still remains. It is located above the concrete utility vault in the room's southeast corner. The hose bibb on the north wall was removed at an undocumented time for undocumented reasons. A hose bibb is located on the south wing's exterior west wall just south of column line B.

The floor drain in the western portion of the mechanical room was replaced with a trench drain in 1991 and is in fair condition. The underground cast iron waste lines beneath the mechanical room, laboratory (104) and tool room (now lunch room, 101) were abandoned at this time and a new single-wall 3-inch PVC underground waste line installed between the trench drain and the concrete utility vault in the mechanical room floor. The floor drain in the southeast corner of the mechanical room was no longer present and was most likely removed in 1991 when the concrete utility vault was added.

A service sink was added in the southeast corner of the mechanical room at an undocumented time. Although the 7/2/91 drawings do not show a sink in this location, it was most likely relocated from the tool room during this construction. The service sink is supported on a cast iron stand with integral p-trap connected to a 3-inch PVC waste line which drains aboveground to the west and drops into the concrete utility vault,

connecting to the new 3-inch PVC waste main. The service sink and cast iron p-trap stand are in fair condition. The faucet is in poor condition.

A sink was originally located along the south wall of the laboratory (104) between column lines 3 and 4 with a 2-inch cast iron waste line connected into the under-slab 4-inch cast iron waste line from the mechanical room (103). The sink was relocated to the southwest corner of the laboratory in 1991 and a 1½-inch PVC waste line routed in the pipe chase into the mechanical room and tied into the service sink's 3-inch PVC waste line aboveground. The laboratory sink's faucet has an integral eyewash. The sink and faucet are both in fair condition.

The water closet in the staff restroom (107) is floor mounted standard height with an exposed flush valve and is in fair condition. The lavatory is wall hung with a single lever faucet and has a large plastic back plate behind it. The lavatory and faucet are in fair condition and the back plate is severely cracked. A shower was added in the northeast corner of the restroom at an undocumented time, but is shown on the 7/2/91 drawings as existing. The shower is a modular unit with a swinging glass door, three resin wall sections, separate resin tub floor and a two handled faucet. The shower is not accessible and is in fair condition. All plumbing fixtures in the staff restroom originally drained into a separate under-slab 4-inch cast iron waste line that connected to the main underground cast iron waste line roughly 5-feet south of the south wing. In 1991 the under-slab cast iron waste lines were removed and replaced with exposed PVC lines in the large concrete utility vault beneath the east portion of the restroom and the west portion of the adjacent paleontologist office (110).

A service sink was originally located in the janitor's closet (108) with an under-slab cast iron waste line connected into the waste line beneath the staff restroom (107). The service sink was removed at an undocumented time and is not shown on the 7/2/91 drawings. The janitor's closet does not have a floor drain. A wall access cover is located in the south wall of the closet allowing access to the staff restroom shower supply lines.

A counter sink was originally located along the south wall of the dark room (109, now part of paleontologist office 110) with an under-slab cast iron waste line connected to the waste line originating beneath the staff restroom (107) outside the foundation. The sink was removed at an undocumented time and is not shown on the 7/2/91 drawings.

A counter sink was originally located in the northwest corner of the geologist office (now part of paleontologist office 110) with an under-slab cast iron waste line running west connected to the waste line beneath the staff restroom (107). The sink was removed at an undocumented time and is not shown on the 7/2/91 drawings.

The south wing originally did not have a roof drainage system other than water ran off the pitched roof to the south. A gutter and six downspouts were added to the south eave at an undocumented time, but most likely when the secondary roof was added in 1997. PVC pipes are located beneath each downspout and run underground, then connect to the new sanitary sewer line installed in 1991 according to park personnel. To allow for

building movement the ends of the downspouts are inserted into the ends of the PVC pipes. The PVC pipe ends are exposed above grade, unpainted, and are susceptible to ultraviolet degradation.

- Admin Wing:

  Original plumbing fixtures and components in the admin wing consisted of the following: electric water cooler on southeast wall in circular portion of the lower lobby (112); service sink on east wall in janitor's closet (206); two water closets, two urinals, two lavatories, and floor drain in men's room (207); four water closets, two lavatories, and floor drain in women's room (207); roof drains and storm drain lines.

  Admin wing plumbing fixtures were originally supplied domestic cold water, hot water, and hot water return with lines routed up through the wall cavity near column A9 into the space below the joists between the admin wing's first and second floors. From the joist space the lines were then routed either up or down within the wall cavities to the fixtures.

  Waste lines were also located in the space below the joists between the admin wing's first and second floors. The waste lines joined together forming a single 4-inch riser dropping within the southeast wall of circular portion of the upper and lower lobbies (112 and 202). The riser penetrated the floor slab and then was originally routed to the west beneath the slab and tied into an existing manhole which connected to an existing sewer line running beneath the service drive to the southeast. The waste line running west beneath the floor slab was replaced in 1967 due to leaks discovered during a 1966 water system pressure test[54]. In 1991 this waste line was abandoned and replaced with a 4-inch single-wall PVC waste line running south/southwest to a new manhole located just outside the admin wing's foundation. The new waste line was installed in a new 18-inch wide concrete utility trench constructed in the admin wing's floor slab. The trench has a brushed on elastomeric liner and was covered with multiple ¼-inch thick steel plates for access and inspection. A 6-inch PVC containment pipe was located between the trench and the manhole with link-seals between it and the 4-inch PVC waste line on the trench end, between it and the foundation wall penetration, and between it and the manhole wall penetration. The containment pipe slopes to the manhole for leak containment and manual leak detection.

  An electric water cooler was originally located on the southeast wall in the circular portion of the lower lobby (112) with a waste line tied into the main waste riser in the wall originating from the visitor restrooms above. The water cooler was relocated to the southeast wall in the circular portion of the upper lobby (202) at an undocumented time. An accessible electric water cooler was installed in this same location in the upper lobby at an undocumented time and is in fair condition.

[54] 07/27/67 - Memorandum – Study proposed repairs…to Visitor Center…to facilitate issuance of bids…, Civil Engineer, D&C, SSC, NPS and 07/01/66 - "Results of Pressure Test on Water System at Visitor Center" , M. Rasmussen, Consultant General Contractor, Vernal, Utah.

A service sink is located on the east wall in the janitor's closet (206). The sink is supported on a cast iron stand with integral p-trap that drains back into the wall and connects to the waste lines in the space below the joists between the first and second floors. The service sink and cast iron p-trap stand are in fair condition. The faucet is in poor condition. The janitor's closet does not have a floor drain.

Two water closets, two urinals, two lavatories, and a floor drain are currently located in the men's restroom (207). The two water closets are located along the north wall, appear to be original, are in fair condition, and are floor mount standard height with exposed flush valves, which are also in fair condition. The two urinals are located on the northeast wall, appear to be original, are in fair condition, and are wall hung with exposed flush valves, which are also in fair condition. Park staff reported that both urinals are slow to drain and they have tried cleaning the waste lines with chemicals, mechanical snakes and rooters with little or no success. A wall cleanout with access cover is located beneath each urinal. The two lavatories are located on the west wall, appear to be original, are in fair condition, and are wall hung with exposed plumbing lines below. The faucets are battery powered sensor operated infrared type in good condition, and were installed in 1998 according to park staff. A wall cleanout with access cover is located beneath each lavatory. The floor drain is set in the tile floor roughly centered in the room and appears to be original. The drain is not at the low point in the floor due to building movement.

Four water closets, two lavatories, and a floor drain are currently located in the women's restroom (208). The four water closets are located along the southwest wall, are in fair condition, and are floor mount standard height with exposed flush valves, which are also in fair condition. Three of the four water closets appear to be original. The northwestern water closet is more modern than the others and was installed at an undocumented time. Park personnel reported that an unknown fixture, possibly a bidet, occupied this northwest stall for an undocumented period. The two lavatories are located along the northwest wall, appear to be original, are in fair condition, and are self-rimming installed in a single counter with exposed plumbing lines below. The faucets are battery powered sensor operated infrared type in good condition, and were installed in 1998 according to park staff. A wall cleanout with access cover is located beneath each lavatory. The floor drain is set in the tile floor roughly centered in the room and appears to be original. The drain is not at the low point in the floor due to building movement.

Water closets in both men's and women's restrooms (207 and 208) do not flush properly due to the sloped floor. Park staff reported that the water pressure was reduced to keep waste water from spilling onto the floor when the water closets are flushed.

Park staff reported that the flush valves on all visitor water closets and urinals were retrofitted with battery powered sensor operated infrared flush operators in 1998. The flush operators are still in good condition. Park staff indicated that they are satisfied with the performance and reduction in maintenance resulting from the infrared sensors on the all visitor plumbing fixtures, including the lavatory faucets.

The admin wing's storm drain system originally consisted of three roof drains located in a perimeter gutter with storm drain risers running concealed in the exterior wall cavity discharging on splash blocks adjacent to the structure. The gutter is no longer visible on the roof, two original roof drains have been abandoned, and two new roof drains have been added. The first abandoned original roof drain was located in the northeast corner of the roof near column B10 and was tied into the drain riser from the exhibit shelter roof, but is now covered with roofing material. The second abandoned original roof drain was located in the southeast corner of the roof, but is no longer visible and was most likely abandoned shortly after construction when the south end of the admin wing began to lift due to the expansive soils. The third original roof drain was located along the west side of the roof near column A9 and is still there. Its drain riser no longer discharges on a splash block adjacent to the structure, but most likely ties into the exhibit shelter's main roof drain riser that runs beneath the south wing's roof sheathing. A roof drain was added just east of the central skylight in 1960[55] and its drain pipe connected to the main waste riser according to a 1989[56] memorandum. Park staff concur that this central roof drain discharges into the sanitary sewer system. A thermostat is located on the roof adjacent to the central roof drain, possibly used to control heat tape on the drain. The thermostat is set at 42-degrees F. Another roof drain was added, possibly in 1993,[57] in the northwest corner as a result of water ponding against the exhibit shelter south wall, which was first documented in 1987.[58] Its drain riser most likely ties into the exhibit shelter's main roof drain riser that runs beneath the south wing's roof sheathing.

Hose bibbs are located on the southwest and northwest exterior walls of the admin wing. They are used to supply water through exposed small diameter copper tubing to the evaporative coolers. As noted in the HVAC section these copper tubes must be blown out before the first freeze in the fall to prevent freezing.

Fire Protection:

The original interior fire protection system consisted of two fire hose cabinets, one located in the east wall of the laboratory (104), the other located beneath the stairs in the lower lobby (112). The hose cabinets were connected to the existing 8-inch cast iron water main that runs along the base of the quarry wall in the exhibit shelter with two separate 2-inch underground branch lines running perpendicular to the main. Each branch line was run in a 6-inch asbestos cement sewer pipe conduit. See the Plumbing section above for a description of the 8-inch water main inside the exhibit shelter, the water supply tanks across the valley, and changes to the water system.

[55] 08/22/60 - Contract to Repair and Remodel the Visitor Center Roof and Completion Report, Maintenance Supervisor, Dinosaur NM.
[56] 05/03/89 - Memorandum – Foundation Exploration of Quarry VC, CE, Branch of Roads and Architecture, RMR.
[57] 08/23/93 - Memorandum – Trip Report, Quarry VC Familiarization. T Windle, CE, RMR.
[58] 05/04/87 - Memorandum - …visually inspect the structural distress in the Quarry Visitor Center…, Bruce Keller, SE, DSC.

In addition to the two interior fire hose cabinets, a hose hydrant was located at base of column B10 according to a 1967 memorandum; although it is not shown on the drawings. This hose hydrant was removed, and the underground water line serving the fire hose cabinet in the lower lobby (112) was rerouted around the new caisson holes in 1967.[59] A 1989 memorandum recommended that this water line be abandoned due to its "potential for a major leak due to corrosiveness of the soil on metal pipe and the slight aggressiveness of the water on metal pipe (heaving of the existing concrete floor may indicate water seeps may now be present)."[60] The fire hose cabinet is not currently located in the lower lobby, and the 1991 drawings do not show the line or the cabinet; so it is likely both were abandoned at this time.

The underground branch line serving the fire hose cabinet in the east wall of the laboratory (104) was abandoned along with the 8-inch cast iron water main at the base of the quarry face in 1991.[61] At this time, a new 1½-inch line was connected to the existing 1½-inch water line in the pipe chase at the base of the south wall in the staff restroom to serve this fire hose cabinet. The new water line is run exposed in the restroom along the west wall and beneath the ceiling.

A wet pipe fire sprinkler system was installed in 1984.[62] Sprinkler heads are currently located in the lunch room (101), mechanical room (103), storage room (103A), laboratory (104), and staff restroom (107). Both the admin wing and exhibit shelter have no fire protection.

The riser for the wet pipe fire sprinkler system is located in the northwest corner of the lunch room. When originally installed this riser connected directly to the 8-inch cast iron water main in the exhibit shelter with a rigid 3-inch line, but in 1991 the 8-inch main was abandoned.[63] At that time a 4-inch PVC branch line was installed between the riser and the 6-inch PVC main line in the concrete vault west of the structure, with a gate valve and pressure relief valve located on the branch line in the vault. The new branch line passes beneath the exhibit shelter's foundation, then rises vertically through the floor into the lunch room, and is encased in a 6-inch corrugated ABS flex-pipe that slopes back to the vault for leak containment and manual leak detection. The new water pipe entry system was designed to be flexible to allow for building movement, and park staff reported it has performed satisfactorily thus far.

The 4-inch fire sprinkler riser is reduced to 2½-inch immediately above the lunch room floor, then connects to a vertical 2½-inch Watts backflow preventer. The backflow preventer has two unsupervised OS&Y valves that appear to be in good condition. A tee for the system's main drain is located above the backflow preventer. The main drain line

[59] 09/06/67 - Repairs to Visitor Center, Quarry Site, Construction Drawings, NM-DIN/3330-A, Revised 04/68, D&C, SSC, NPS.
[60] 08/31/89 - Memorandum – Water and Wastewater Field Evaluations - Chief of Professional Support Division, DSC.
[61] 07/02/91 - "Water/Sewer Reconstruction – Quarry Visitor Center", Construction Drawings, 122/80045, RMR.
[62] 10/15/85 - Memorandum - Chief Curator, NPS and 11/11/85 - "Conduct fieldwork for the National Historic…Landmark Theme Study…", Arch Historian, SWRO.
[63] 07/02/91 - "Water/Sewer Reconstruction – Quarry Visitor Center", Construction Drawings, 122/80045, RMR.

has a pressure gauge, and terminates at a hose connection located near the floor in the exhibit shelter just west of the double doors to the lunch room (101). Above the main drain tee, the 2½-inch riser has a water flow switch attached, then continues up to the ceiling and branches out into the sprinkler piping. The sprinkler piping is run exposed beneath the ceilings and all sprinkler heads are upright in all five rooms protected by the wet pipe system. A sprinkler test valve is located at the east end of the sprinkler piping near the ceiling in the staff restroom (107).

A Halon 1301 fire protection system was installed in the paleontologist office (110) and the library (111) in 1984.[64] Park staff reported that this system was selected to protect the one-of-a-kind documents stored in both rooms without the threat of water damage. The Halon cylinder and controls for the paleontologist office are located in the janitor's closet (108). The Halon cylinder and controls for the library are located behind the library's door along the north wall. All piping is run exposed along the walls and beneath the ceilings. It should be noted that Halon requires significant enclosure integrity to be effective; otherwise it can actually accelerate a fire. With windows that will not close and numerous cracks in the walls, it is doubtful that adequate enclosure integrity exists, or can be achieved in the building's current condition.

Exterior fire protection equipment is not shown on the original construction drawings; however the 1962 "As Constructed" drawings show two exterior fire hydrants with adjacent hose boxes connected to the 8-inch cast iron water main.[65] One fire hydrant and hose box is shown on the 1962 drawings approximately 85-feet east of the exhibit shelter on an island in the parking lot. This hydrant/hose box was relocated to the south side of the service drive in the southwest corner of the parking lot when the 8-inch water main in the exhibit shelter was abandoned in 1991.[66] The other fire hydrant and hose box is shown on the 1962 drawings approximately 85-feet west of the exhibit shelter at the base of the quarry hill, and is currently in this same location.

Park staff reported that a water flow and pressure test using the hydrants has not been performed to determine the water supply characteristics of the site.

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[64] 10/15/85 - Memorandum - Chief Curator, NPS and 11/11/85 - "Conduct fieldwork for the National Historic…Landmark Theme Study…", Arch Historian, SWRO.

[65] 08/16/62 - Visitor Center Plaza Reconstruction, Construction Drawings, NM:DIN/3149C, Western Office Design and Construction, NPS.

[66] 07/02/91 - "Water/Sewer Reconstruction – Quarry Visitor Center", Construction Drawings, 122/80045, RMR.

Electrical Condition Assessment

General

Historic Conditions: The original 1956 drawings show a complete electrical system inclusive of telephone jacks. Much of the 1956 equipment remains in place, in terms of conduit, boxes, and some light fixtures.

In 1976, the service power pole and weather head were removed, and an underground service with a pad mounted transformer located 160 feet west the building was installed.

The structure was rewired under contract in 1996. A new switchboard was installed at that time and the metering was moved outside of the building, next to the pad-mounted transformer, 160 feet away.

2003 Conditions

Existing Primary Electrical Distribution System – Commercial power is provided to the site by Moon Lake Electric via an underground primary line. The 7200 volt, three-phase, utility owned underground primary service ties directly into the pad-mounted transformer located approximately 160 feet from the building. Power is converted into 120/208 volt, 350A, three-phase service with phase neutral. The service from the transformer to the main switchboard consists of 3-250 kcmil plus 1 – 250 kcmil neutral copper wires and 1 – 2 G in 2 ½" conduit. Metering, provided by Moon Lake Electric, is located next to the pad-mounted transformer, 160 feet away from the visitor center.

System Loading – The exhibit lighting and the hall lighting remain off at all times. Also, the original mechanical equipment has been replaced with swamp coolers and window mounted air conditioned units, which affects the electrical load by reducing the branch circuit capacity. Therefore, the current electric usage does not reflect future total-system consumption and can only be estimated in determining demand range.

System Capacity – Full load capacity of the visitor center's existing 120/208 volts, three-phase, 4-wire electrical service is 109.7 KVA. Assuming a system power factor of 0.85, the resultant full-load capacity is 93.2 kW.

The overall capacity of the electrical distribution system is not sufficient to support supplemental loads. The transformer does not have sufficient capacity to support any unanticipated additional electrical requirements.

Existing Secondary Electrical Distribution System – Power from the main switchboard, located in the Mechanical Equipment Room (Room 103), is fed to the panelboards located in the main switchboard, the Janitor Closet (Room 108) and the Preparation Lab (Room 104). The panelboards appear to be in good condition.

The existing branch circuit wiring was installed in 1996. Some modifications were done to the

electrical system in 1996 or later.

All the receptacles in the building appear to be operational and in good condition. However, with the building movement, some of the conduit may be broken, making it impossible to pull new wiring through it. Isolated ground receptacles have been added for computers; however, the existing panelboards do not have an isolated ground bus.

In the Visitor Gallery, there is only one receptacle for the entire area.

Existing Emergency System – There is no existing emergency system at this time.

At the present time, there are no critical loads requiring emergency power.

Lighting

2003 Conditions. There are no luminaries in the South wing that could be considered historic. The existing lighting system consists of fluorescent light fixtures and track lighting. The system was replaced in 1996.

The lights in the hall of the South wing and the exhibit lights in the Visitors Gallery remain off at all times. The incandescent exhibit lights produce a large amount of heat.

The lights in the restrooms, the kitchen, and the Mechanical Equipment Room (Room 103) are controlled by motion sensors. All other lights are controlled by manual switches.

Communications Systems.

2003 Conditions. The telephone cable is direct buried from the pedestal located 138 ft. from the building. The pedestal appears adequate. However, the telephone terminal board located in the Mechanical Equipment Room (Room 103) is exposed to dirt and not very neatly wired.

Currently, the server for the network system is located in the town of Vernal, Utah.

Fire Detection and Alarm System:

2003 Conditions. A fire detection system was installed in 1996. The fire alarm control panel is a Fire Control Instruments, Inc. panel. The park staff is very happy with the existing system. However, the system lacks audio/visual devices (strobes) and therefore does not meet NFPA.

Security Alarm System:

2003 Conditions. A security alarm system was installed in 1996. The park staff is very happy

with the existing system.

A Telephone Dialer by United Security Products, Inc. (USP), Model AD 2000, is located next to the Security Alarm Control Panel.

Lightning Protection. There is no lightning protection for the Quarry Visitor Center.