

U.S. Fire Administration

Bonfire Collapse

Texas A&M University

College Station, Texas - November 1999

Technical Report Series - USFA-TR-133



FEMA

UNITED STATES FIRE ADMINISTRATION FIRE INVESTIGATIONS PROGRAM

The United States Fire Administration develops reports on selected major fires throughout the country. The fires usually involve multiple deaths or a large loss of property. But the primary criterion for deciding to do a report is whether it will result in significant “lessons learned.” In some cases these lessons bring to light new knowledge about fire — the effect of building construction or contents, human behavior in fire, etc. In other cases, the lessons are not new but are serious enough to highlight once again, with yet another fire tragedy report. In some cases, special reports are developed to discuss events, drills, or new technologies which are of interest to the fire service.

The reports are sent to fire magazines and are distributed at national and regional fire meetings. The International Association of Fire Chiefs assists USFA in disseminating the findings throughout the fire service. On a continuing basis the reports are available on request from USFA; announcements of their availability are published widely in fire journals and newsletters.

This body of work provides detailed information on the nature of the fire problem for policymakers who must decide on allocations of resources between fire and other pressing problems, and within the fire service to improve codes and code enforcement, training, public fire education, building technology, and other related areas.

The Fire Administration, which has no regulatory authority, sends an experienced fire investigator into a community after a major incident only after having conferred with the local fire authorities to insure that USFA’s assistance and presence would be supportive and would in no way interfere with any review of the incident they are themselves conducting. The intent is not to arrive during the event or even immediately after, but rather after the dust settles, so that a complete and objective review of all the important aspects of the incident can be made. Local authorities review USFA’s report while it is in draft. The USFA investigator or team is available to local authorities should they wish to request technical assistance for their own investigation.

This report and its recommendations were developed by USFA staff and by Varley-Campbell & Associates, Inc. Miami and Chicago, its staff and consultants, who are under contract to assist the Fire Administration in carrying out the Fire Reports Program. The United States Fire Administration greatly appreciates the cooperation received from College Station Fire Department, Bryan Fire Department and Texas A&M University

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Bonfire Collapse Texas A&M University College Station, Texas

November 18, 1999

Investigated by: John Lee Cook, Jr.

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Federal Emergency Management Agency

United States Fire Administration



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**TEXAS A&M UNIVERSITY
COLLEGE STATION, TEXAS**

NOVEMBER 18, 1999

Investigated By: John Lee Cook, Jr.

The Federal Emergency Management Agency, United States Fire Administration gratefully acknowledges the cooperation of the staff of Texas A & M University and the members of the Bryan and College Station Fire Departments. Everyone who assisted in the preparation of this report was generous with their time, expertise, and counsel.

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OVERVIEW

In keeping with a ninety-year old tradition, fifty-eight people were working to construct the fourth tier of the 1999 bonfire stack on the campus of Texas A&M University during the early morning hours of November 18, 1999. The bonfire is ignited every year on the eve of football game between Texas A&M and its arch rival the University of Texas at Austin. The forty-foot stack, consisting of approximately 5,000 logs, collapsed killing eleven people and sending twenty-eight to area hospitals. One of the injured would later die, bringing the total number killed in the incident to twelve.

There were emergency medical personnel from the University's Emergency Medical Service at the scene when the collapse occurred. EMS personnel immediately began to triage the injured bonfire workers and to assist with the rescue effort.

The first call to 911 was received by the City of College Station's Emergency Communications Center at 02:43 hours. The caller reported that the bonfire stack had collapsed on campus and as many as thirty people may be trapped. An engine company and an ALS ambulance from the College Station Fire Department were dispatched and arrived on the scene within four and one half minutes.

The first firefighters to arrive at the incident were confronted with a scene eerily reminiscent of the children's game of pick-up-sticks. Command was established and additional resources were ordered immediately upon realization of the magnitude of the event. The rescue and recovery effort lasted almost twenty-four hours and involved over 3,200 individuals from over fifty different agencies.

The magnitude and unique nature of the incident quickly attracted national attention. At the height of the incident, approximately fifty satellite television trucks were broadcasting from the scene, including a number of regional television stations that broadcast live from the scene throughout the event. Several of the news agencies were from Spanish language only media organizations.

There were three distinct phases of operations during the event. The first phase, involved the triage and rapid transport of the majority of the victims. Twenty-seven of the twenty-eight victims who required transport to a medical facility were transported within the first hour. A twenty-eighth victim was severely pinned within the stack and could not be transported until he had been extricated. Phase Two of the incident involved the prolonged and tedious process of extracting victims who were still alive from the stack. The final phase encompassed the removal of the bodies of the deceased and the complete dismantling of the bonfire stack.

Texas A&M University is a close-knit community and the tragic event had a significant impact not only on the student body, but the local community as well. The out-pouring of assistance and support from the citizens of the area as well as from other universities throughout the state was overwhelming.

Shortly after the incident, the President of the University appointed an independent commission of inquiry to determine the cause of the collapse. The commission was

assisted in their inquiry by a number of experts as well as staff from the University. On May 2, 2000, the Commission released their much-anticipated findings.

Their inquiry concluded that the 1999 bonfire collapsed due to a number of both physical and organizational factors. According to the Report's Summary of Findings, the structural collapse of the bonfire stack was driven by a containment failure in the first stack of logs. Two primary factors caused this failure: the first was excessive internal stresses driven primarily by aggressive wedging of second stack logs into the first stack. The second was inadequate containment strength around the first stack, which resulted in structural failure.

Hoop stress results from outward pressure in a cylindrical structure, like a barrel, that is due to internal lateral forces. Design, shape, or even gravity can drive these forces. Hoop strength is the ability of a cylindrical structure to contain hoop stress. Hoop strength is normally provided by some containing mechanism; the metal hoops on a barrel for example. The lack of metal cables on the first tier reduced the hoop strength on the first tier and contributed to the structural collapse.

Organizational factors resulted in an environment in which a complex and dangerous structure was allowed to be built without adequate physical or engineering controls. Organizational failure included the absence of an appropriate written design or design process; a cultural bias, which impedes risk identification; and the lack of a proactive risk management approach.

In addition to the special bonfire commission, OSHA and the Texas Alcoholic Beverage Commission conducted inquiries into the collapse in order to determine if any of their regulations were violated by any of the participants of the bonfire. Neither agency uncovered any act or violation, which warranted any further action.

| KEY ISSUES | |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Issues | Comments |
| Communications | <p>An event of this magnitude can quickly exceed the capabilities of not only the communications systems utilized by the emergency responders, but also the telecommunications systems used by the community at large. University students were instructed to call home and to notify their families that they were okay. The enrollment at the University exceeds 43,000 and the volume of calls that were made overwhelmed both the telephone and cellular systems. Additionally, so many calls were placed to the two local hospitals that their telephone systems were overloaded as well.</p> <p>College Station uses an 800 MHz trunked radio system. Bryan uses a VHF system, but had installed 800 MHz radios in their apparatus just ten days prior to the incident. College Station also has VHF radios for a totally redundant system. The use of cellular phones by rescuers and the news media contributed to the overloading of the cellular system for much of the event.</p> |
| Pre-Incident Planning | <p>There was an inter-jurisdictional emergency management plan in effect. A tabletop exercise had been conducted one week prior to the event with both cities and the university participating. The local plan was up-to-date and the key people involved knew each other and work together on a regular basis. As one individual described it, there was “no need for an introduction” at the incident site. The University EMS service had also conducted a MCI drill just two weeks prior to the incident.</p> |

KEY ISSUES (Cont.)

| Issues | Comments |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Incident Management | More than 3,200 people from more than fifty agencies were involved in the resolution of the incident. An incident management system is absolutely critical for an incident of this magnitude. Fortunately, such a system was in place and was utilized to resolve the incident. |
| Resource Management | An event of this magnitude requires a considerable amount of human and material resources. The availability and source of for these resources must be identified prior to an event actually occurring. Resource lists must be kept up to date and procedures must be in place that allow for the rapid mobilization of the resources. |
| Community Impact | The outpouring of support and assistance from the community was overwhelming. As one rescuer stated, you would ask for one of something and suddenly three would appear. Local restaurants supplied food to the rescuers and area hotels provided accommodations for the family members of the victims. The tragic loss was felt in the tight-knit community as well. |
| Rumor Control | So much misinformation was being broadcast about the incident that the television sets in the two local hospitals were all turned off to reduce the anxiety of the friends and family members of the victims of the incident. The PIO staff at the incident did a good job, however, of conducting timely briefings to keep the media informed. Over fifty television satellite trucks responded to the incident. |

TEXAS A&M UNIVERSITY

Texas A&M University is located in College Station, Texas approximately equidistant from three of the ten largest cities in United States, Houston, Dallas, and San Antonio, and the state capital, Austin. The University's enrollment in the fall of 1999 was 43,442 students, which places the school among the five largest universities in the nation. Originally founded as an all male institution, women now constitute almost half of the total enrollment. African Americans and Hispanics comprise approximately eleven percent of the student body.

The first public institution of higher education established in Texas, the University opened its doors with forty-eight students on October 4, 1876 as the Agricultural and Mechanical College of Texas. A&M is a land grant; sea grant and space grant institution and owes its origin to the Morrill Act of 1862, which established the nation's land-grant college system.

In 1963, the name of the institution was changed to Texas A&M University. Today, the school occupies a 5,200-acre campus with more than 100 buildings, with an assessed value of over \$1 billion. The University is the home of the George Bush Presidential Library and the Texas A&M Corps of Cadets. Excluding the service academies, the Corps is the largest uniformed student organization in the nation with ROTC programs in all branches of the armed services. The current strength in the all-voluntary program is approximately 2,200 students.

In 1929, the State Firemen and Fire Marshal's Association of Texas chose A&M as the site for a training program for volunteer firefighters. In 1931, the State Legislature instructed A&M to create and operate a permanent training school for both career and volunteer firefighters. In 1954, the training mandate was expanded to include industrial firefighters. The Firemen's Training School (FTS) is now a part of the Texas Engineering Extension Service (TEEX), a division of the University, and has grown to become one of the largest fire training schools in the world.

Texas Task Force One, a FEMA Urban Search and Rescue Team, is also headquartered at the FTS. The USAR Team maintains more than \$1.3 million dollars worth of state-of-the-art equipment and its members include 186 emergency services personnel from forty-eight organizations and departments throughout the state. Members are divided into three sixty-two-member teams, which are on a thirty-day rotational call. Each team has five components: a command structure, a rescue group, a medical group, a technical group, and a search group that has a canine search component.

THE BRYAN-COLLEGE STATION METROPOLITAN AREA

College Station has a population 62,000 and is located in the Brazos River Valley of east central Texas, about 140 miles north of the Gulf of Mexico. The Brazos County community was named as a railway stop by the Postal Service in 1877. Contiguous with the City of Bryan, College Station was planned, as a model community by college professors when the college could no longer accommodate their living needs on campus. When A&M opened its doors to women in the 1960's, the city's population began to rapidly increase and is currently one of the fastest growing metropolitan areas in the nation.

Prior to 1970, fire protection was provided by a volunteer fire department that was operated by the University. In 1970, the City created its own fire department, which is now all career with eighty-four employees. Sixty-nine personnel are assigned to suppression shifts and are deployed in four stations and staff eight pieces of apparatus. A fifth station has been approved and is scheduled to open by 2003. The department is organized in three divisions: Administration, Operations, and the Fire Marshal's Office. The Operations Division provides EMS transport service within the City and by contract in the southern half of Brazos County.

Firefighters work three shifts (24/48). A Battalion Chief commands each shift and minimum staffing is seventeen per shift, three per engine and ladder company, and two for an ambulance. Firefighters respond to over 4,000 incidents each year, with EMS calls constituting approximately 70 percent of the total incident volume.

The City of Bryan, population 61,400, borders College Station to the north. Bryan is the county seat of Brazos County, population 130,000. The original town site was established in 1859 on 640 acres and the earliest recorded population indicated that there were between 300 and 500 residents. The City was incorporated in 1871 and has grown over the years to its current size of 32.3 square miles.

The Bryan Fire Department was organized on July 5, 1871 and was incorporated by the State of Texas as Hook and Ladder Company Number One. In the 1880's, the volunteer company purchased the first LaFrance steam fire engine to be used in Texas. The first career firefighter was hired in 1921 and now the department is all career with a staff of seventy-eight. The Department operates four stations and staffs four engine companies, one aerial platform, and two ambulances. Firefighters work a 24/48 schedule and a Deputy Chief is in command of each of the three shifts. The department responds to more than 7,000 calls for service each year, approximately 60 percent are for EMS calls.

THE TRADITION

Texans take their football very seriously, whether it is a peewee game played in the local park on Saturday morning or a Sunday afternoon game at Texas Stadium involving the Dallas Cowboys. Yet, one would be hard pressed to find a more intense rivalry than the annual football game between Texas A&M University and its archrival, the University of Texas at Austin (UT and also known as TU). The game is traditionally played each year during the week of Thanksgiving and one of the key events surrounding the game is the burning of the bonfire, which takes place on the A&M campus on the eve of the game.

The ninety-year old tradition has evolved over the years, but traces its origin to 1909 when students ignited a pile of trash gathered on the spur of the moment in anticipation of the game with UT. The earliest available photograph of the bonfire dates from 1928 and shows a bonfire stack that was constructed of wooden pallets, tree limbs, and other similar materials. In 1943, the bonfire gained increased notoriety when it was featured in a Hollywood motion picture entitled *We've Never Been Licked*. In 1945, the first center pole was used and the bonfire was constructed entirely of logs in a teepee configuration, which was topped by an outhouse. The wedding cake configuration of recent bonfires dates to 1978.

Attendance at the annual ritual has grown over the years and ranges from 30,000 to 70,000 spectators, depending on such factors as weather and the quality of A&M's and UT's football teams. The 1999 bonfire would have been the 89th one to be burned. The bonfire was cancelled in 1963 in response to the assassination of President Kennedy in Dallas on November 22nd,.

The 1999 bonfire was either the 90th or 92nd to have been built, depending upon one's point of view. The bonfire stack collapsed without incident in 1957 and again in 1994. Both stacks were hastily rebuilt and were burned as scheduled. Hence the dispute about the number of stacks constructed during the last ninety years. Appendix C provides a chronological history of significant events surrounding the bonfire and provides a description of the command hierarchy used to construct the bonfire stack.

Over the years, the bonfire has been held a number of places on campus. Since 1992, the event has been held at the Polo Fields on the north side of the campus. The bonfire is a student-managed event and approximately 125,000 man-hours are expended to construct the stack. Nearly 5,000 students and former students participate in the cutting, hauling, and stacking of the 6,000 to 8,000 logs that are

used to construct the bonfire structure. Area landowners wishing to clear their land donate the trees used in the event.

The bonfire event has not been without its critics, particularly environmentalist who decry the impact of cutting the trees and the air pollution generated by the fire. Since 1991, however, students have carried on a new tradition by planting approximately 10,000 replacement trees each spring to show support for both the bonfire and the environment.

The saga of the bonfire is rich in folklore. UT students have attempted to ignite the bonfire prior to the scheduled event a number of times. Among their more creative efforts were attempts in 1933 and 1948 to drop firebombs from airplanes. None of the attempts, however, have proven to be successful.

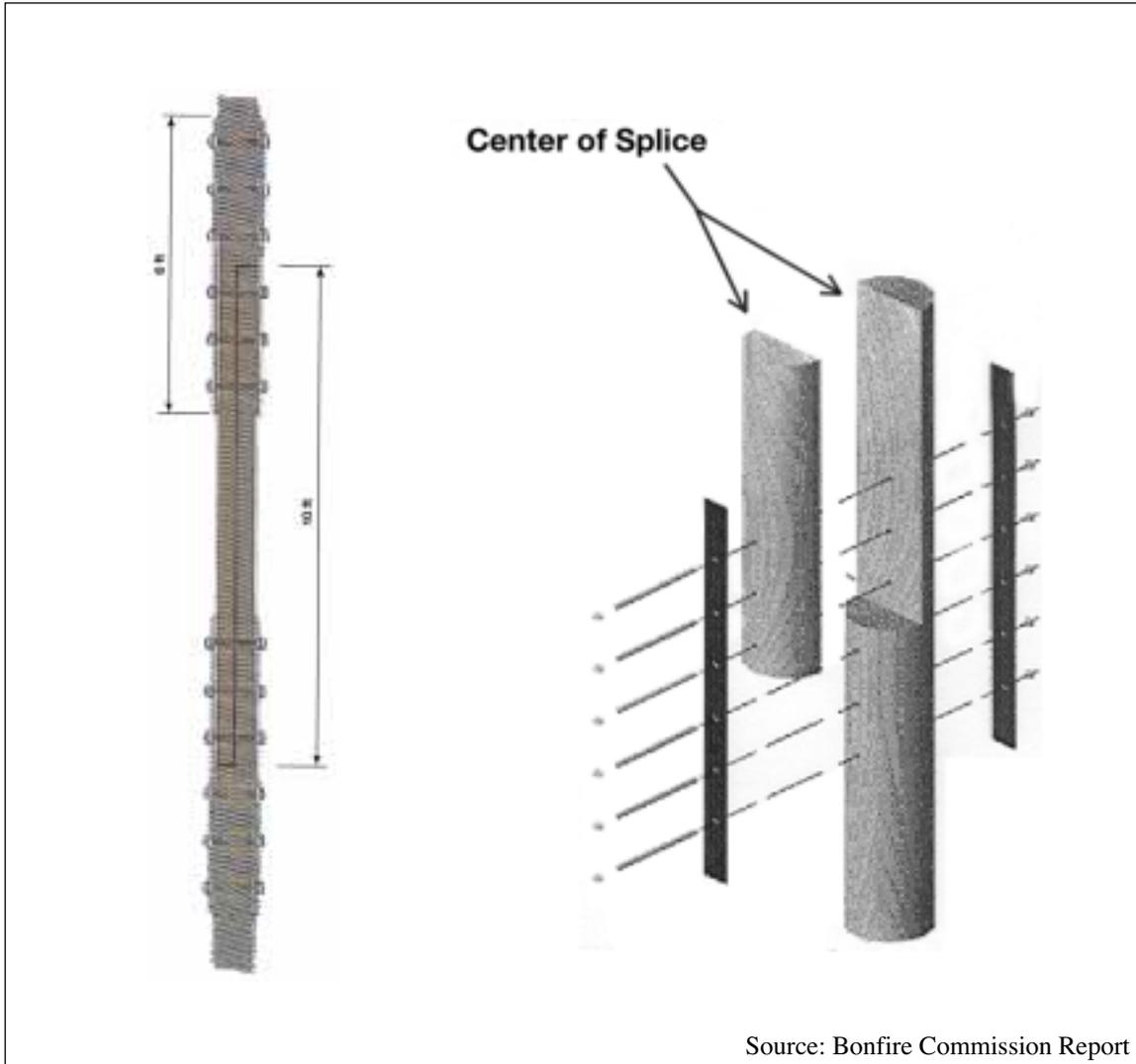
The first seventy bonfires were male only affairs. In 1979, women were first allowed to help construct the bonfire. For much of its history, Texas A&M was an all male institution. Women were admitted to the University during the 1960's and are now very much a part of the activities surrounding the event.

CONSTRUCTION

In 1999, cutting began on October 3rd and the stacking process would have normally taken from two to three weeks to complete. Prior to the actual construction of the stack, the ground is lime stabilized and compacted as a precaution. In 1994, heavy rains just prior to the bonfire caused the stack to collapse when the ground underneath the stack became unstable. A center pole, first used in 1945, is set and the logs are stacked in six tiers around the center pole in a wedding cake design. The 1999 center pole arrived on site on October 30th.

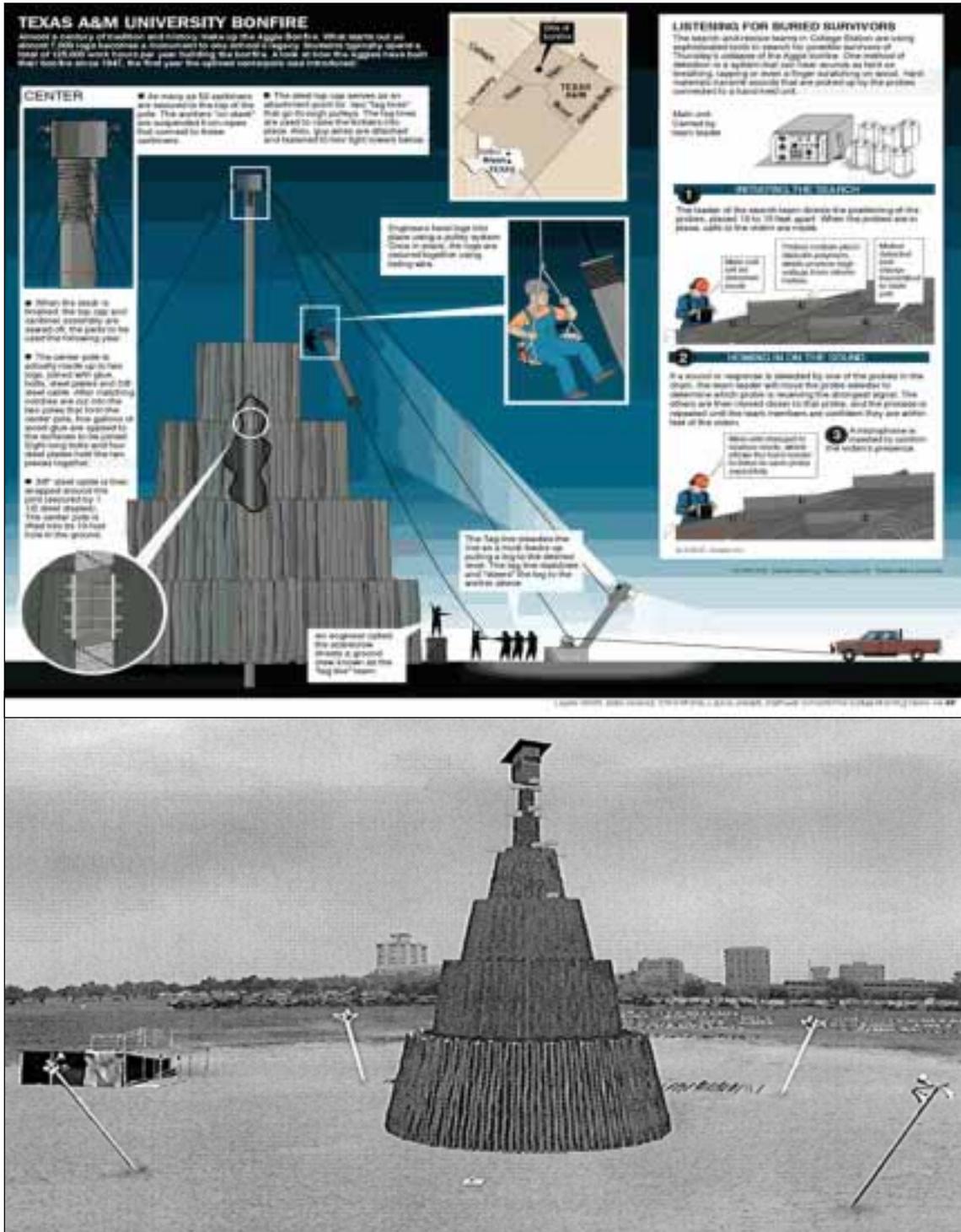
The Center pole is constructed using two utility poles, which are spliced together. The 1999 center pole was 105 feet long and was buried approximately fourteen feet in the ground. The two matching notches, approximately ten feet long, are cut into the poles and the notches are joined together with five gallons of glue. Eight long bolts and four steel plates are added to secure the joint. A 3/8-inch cable is then wrapped around the joint and the cable is secured to the pole with steel staples. The diagram in Figure One, below, provides an illustration of the technique employed in the construction of the center pole.

Figure One
Center Pole Design



A top cap is added to the center pole and serves as an attachment point for two “tag lines” that go through a series of pulleys. The tag lines are used to raise the timbers. Guy ropes, consisting of one inch manila ropes having a rated load capacity of 1,900 pounds, are also attached and are fastened to four light towers for stability, as illustrated in Figure Two, below. The lights are necessary since most of the construction takes place after dark. Approximately fifty carabiners are secured to top of the pole, which are used by the workers on the stack. They are suspended with ropes that connect to carabiners and assist with the hoisting of the logs onto the stack. Each log is individually secured to the stack with bailing wire.

Figure Two
Bonfire Diagrams



Source: Austin360.com and Bonfire Commission Report

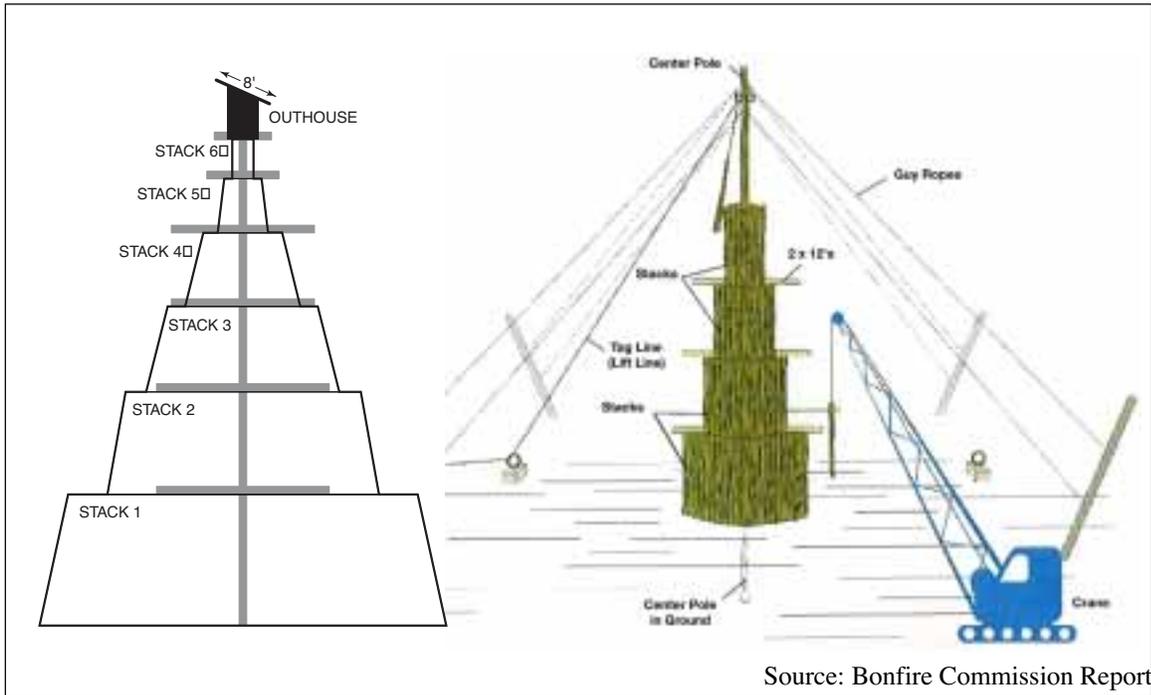
There are no official guidelines regulating the actual construction of the stack, but recommendations are passed down each year from the Red Pots. The Red Pots are a group of nine seniors and nine juniors that actually manage the overall construction of the bonfire. The Red Pot in overall command is known as the Head Stack. See Appendix C for a complete breakdown of the organizational structure of the group that constructs the bonfire.

By 1969, the bonfire stack had grown to over 109 feet as each succeeding class tried to outdo the one before. Since 1970, however, the finished stack has been intended to be limited to fifty-five (55) feet in height and forty-five feet in width as a safety precaution. Surveying equipment is used to make sure that the center pole is straight and to mark how high each of the six tiers will reach. Four perimeter poles are also placed 150 feet away and ropes are stretched from the perimeter poles to center pole and tension is placed on the lines in order to hold the wooden spine together.

The majority of the work is performed manually, but cranes are used to assist in lifting the logs onto the higher tiers. The cranes are donated and there are volunteers from construction companies on site during the construction process to offer advice to the students, although the advisors do not participate in the actual construction of the stack. Construction crews work in two shifts. The first shift works from 18:00 hours until midnight. The second shift starts at midnight and works until 06:00 hours. Fortunately, a rigid accountability system is used to monitor the workers at the construction site. Many workers do not routinely carry identification on their person during a normal shift and the accountability system proved invaluable in the identification of the collapse victims.

Fay Engineering Corporation of Denver, Colorado prepared a historical description and examination of the bonfire for the special commission, which investigated the 1999 collapse. As a part of their research, a composite design was prepared based upon photos of the bonfire from 1978 to 1998. The photos were located in the archives of Cushing Memorial Library. A diagram of the composite stack is illustrated in Figure Three, below, and represents an average of the cumulative designs.

Figure Three
Composite Design



In addition, the dimensions of the composite design are listed in Table One, below.

Table One
Composite Bonfire Measurements
1978-1998

| Overall Height: | Base Diameter: | Number of Stacks: | Height at 4th Level: |
|------------------------|-----------------------|--------------------------|-----------------------------|
| 72' | 57' | 6 | 59' |
| Stack | Height | Top Diameter | Bottom Diameter |
| 1 | 20' | 48' | 57' |
| 2 | 15' | 33' | 38' |
| 3 | 13' | 21' | 27' |
| 4 | 11' | 11' | 16' |
| 5 | 8' | 5' | 7' |
| 6 | 6' | 3' | 3' |

Source: Fay Engineering Corporation

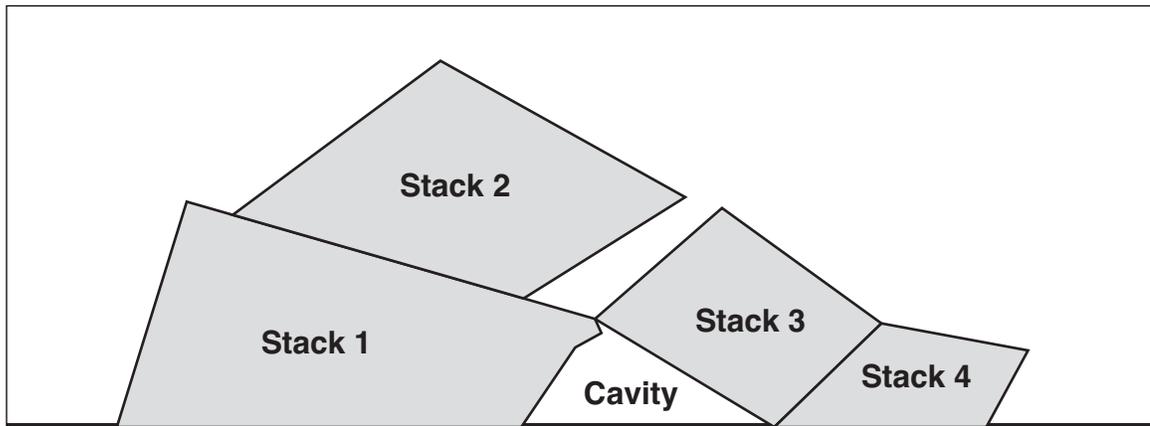
The bonfire stack is “crowned” with an outhouse affectionately known as the “t.u. tearoom or frat house”. The outhouse is approximately seven feet tall and is not included in the fifty-five foot standard construction height. An Austin highway sign is also placed at the top and traditionally lists the sophomore class year as the miles to Austin. In

previously times, the outhouse and highway sign were “acquired”, but now are built by the students or are donated for the event. The bonfire is ignited using 700 gallons of diesel fuel, which is applied by members of the Fire Training School staff. When ignited, the spiral arrangement of the stack causes the bonfire to collapse into itself in a twisting motion as it burns.

THE COLLAPSE

On Thursday morning, November 18, 1999, approximately fifty-eight people were working to erect the fourth tier of the bonfire stack at the Polo Grounds, which is located on the north side of the campus near the intersection of University Drive and Bizzell Street. At 02:40 hours, the forty-foot stack of logs collapsed, falling generally in a southeasterly direction. A diagram of the collapse configuration is included as Figure Four, below

Figure Four
Bonfire Stack Collapse Diagrams



Source: Bonfire Commission Report

The collapse occurred with little or no warning. Several survivors reported that they heard a loud “pop” just seconds before the collapse, while others reported that they heard a low, thunderous popping noise. Regardless, everyone interviewed after the collapse stated that the bonfire stack fell too quickly for anyone to have escaped. Twelve people were killed and twenty-seven were injured. A male student suffered the most severe injuries and was hospitalized until April 14, 2000. He spent a total of eighty-three days in intensive care and his left leg was amputated above the knee.

As a safety precaution, no more than seventy workers are ever permitted to be on the stack at any one time. In addition, emergency medical personnel are required by University regulations to be on site whenever there are workers on the bonfire stack. When the collapse occurred, a paramedic, two EMTs, and three individuals with CPR and first-aid training were at the site. The paramedic immediately assumed command of victim triage and the emergency care providers began to render aid to the injured.

At 02:43 hours, the first telephone call reporting the collapse was received by the 911 Communications Center in College Station. The caller reported that the bonfire stack had collapsed and that there may be as many as thirty people trapped in the debris. The College Station Fire Department was dispatched and an ALS Ambulance and Engine Company 721, with a total crew of five, responded on the initial alarm. While enroute to the scene, the Engine Company Lieutenant requested that another ambulance and the Battalion Chief be dispatched to the incident.

The first units went on location four and one half minutes after being dispatched and relayed the extent of the collapse to the Dispatcher. Emergency responders were greeted with a scene eerily reminiscent of the children's game of pick-up-sticks. Events then began to rapidly unfold.

The University has its own Police Department (UPD). The UPD immediately requested that all of their officers be dispatched to the scene and began to notify key personnel in accordance with the University's Emergency Management Plan. Then, UPD secured the incident scene with the assistance of law enforcement officers from the cities of College Station and Bryan and deputies from the Brazos County Sheriff's Department. Fortunately, an inner perimeter was already in place. Yellow tape similar to that used by fire and police departments to mark the boundaries of an incident is always placed around the bonfire construction site in order to control access to the stack. The pre-established perimeter served to control access to the site throughout the duration of the incident.

Upon arrival, the College Station Battalion Chief assumed command of the incident and established a command post on the east side of the collapse site. The Battalion Chief's vehicle was originally used as the command post, but as the incident grew in magnitude. One of the military units that subsequently responded to the incident erected a tent, which served as the command post for the duration of the event. As the incident progressed, the local telephone company ran a number of landlines to the command post and personnel from the University's physical plant extended electrical service to the command tent.

The initial size up revealed that there were at least twenty-three people injured and possibly as many as ten fatalities pinned within the stack. Based upon this assessment, the Incident Commander ordered that two additional ambulances and another engine company be dispatched from College Station. He also requested three ambulances and the Truck Company from Bryan as well as the University's two ambulances. Staffed entirely by students, the University's EMS service is used exclusively to transport sick and injured students on the campus.

Command assigned the Lieutenant from Engine Company 721 to coordinate the EMS transportation sector. A triage sector for the walking wounded was also established and two salvage covers were placed on the ground to accommodate the more critically injured patients. The on-duty Deputy Chief from Bryan responded on his own initiative and was assigned by Command to manage the Rescue Sector, which was located on the south side of the stack.

Command then requested that the private ambulance service from St. Joseph's Hospital, which normally only handles patient transfers, be dispatched to the scene. Command also requested that a general alarm be declared. A general alarm designation activates the recall of all of College Station's off-duty firefighters.

At 02:50 hours, the automatic aid assistance from Bryan began to arrive. Bryan's Deputy Chief requested that his Dispatcher send the Department's seventeen member urban search and rescue team to assist with the rescue effort and he also initiated the callback of Bryan's off-duty firefighters.

In the mean time, Command requested that the Emergency Operations Center (EOC) be activated to help coordinate all of the resources that would be required to manage the incident. He also appointed a Resource Officer to coordinate activities at the scene and a Staging Officer to manage the influx of emergency vehicles and rescue personnel. As with any event of this magnitude, a number of would be rescuers dispatched themselves without being officially requested. As is normally the case, this contributed to the confusion and congestion, which often accompanies large-scale events.

Upon being informed of the incident by the UPD dispatcher, several members of the Fire Protection Division's Staff responded to the scene with the apparatus belonging to the State's Urban Search and Rescue Team. Known as Texas Task Force One, the team is headquartered at the Firemen's Training School (FTS), which is located on the western edge of the University campus. At the time of incident, the task force had not been granted FEMA USAR status. That status has been recently conveyed upon the team.

There are 186 members on the task force and they occupy nineteen different positions ranging from medical doctors to K-9 search and rescue units. Forty-eight Texas cities and agencies are represented on the team. Although the Task Force was not officially activated during the incident, a number of team members utilized the team's listening devices and search cameras to help locate victims trapped within the bonfire stack. The Task Force members were assisted by structural engineers from the University's Department of Civil Engineering to evaluate the structural stability of the collapsed stack of logs, which were precariously balanced on top of each other. Task force members from Austin, Dallas, Houston, and San Antonio also responded to the incident and were used as relief crews during the mammoth rescue effort.

The FTS routinely conducts a 400+ hour academy to train entry-level career firefighters and the students from the Recruit Class were summoned to the scene by members of the Fire Protection Training Staff to assist with the rescue effort.

Management of the incident assumed three separate and distinct phases. The initial phase consisted of the triage and immediate transport of patients who were not severely pinned beneath the collapsed stack. The triage process determined that a total of twenty-eight individuals required transportation to a hospital. Twenty-seven of those patients were transported within the first hour of the incident. The twenty-eighth victim was severely pinned and could not be transported until being extricated from the collapsed bonfire stack.

EMS Officials reported that eleven patients were taken to College Station Medical Center and seventeen patients were transported to St. Joseph's Hospital in Bryan. An undetermined number of patients did not require transportation to a medical facility and were treated at the scene and released. None of the emergency responders were injured during the rescue and recovery effort, which was indeed fortunate when one considers the number of personnel involved in the incident as well as the duration of the event and the physical effort required to bring the incident to resolution.

Phase Two of the incident consisted of those efforts directed at locating and rescuing victims who were pinned within the stack, but who were still alive. These efforts were labor-intensive and required the commitment of a significant amount of human and material resources to accomplish. Requests for manpower and equipment were relayed to the EOC who in turn contacted the sources identified in the joint Emergency Operations Plan. The exact number of people involved in the bonfire collapse incident is unknown, but it is estimated that approximately 3,200 people from at least

fifty different agencies were involved in some capacity during the incident. A summary of those who assisted in the rescue and recovery effort is listed in Table Two, below, and a list of the participating agencies is provided in Appendix D.

Table Two
Number of Participants By Category

| Agency | No. | Agency | No. | Agency | No. |
|----------------------|-----|----------------------|------|----------------------|-------|
| Appointed Officials | 24 | Human Services | 172 | Public Participants | 764+ |
| Communications | 38 | Law Enforcement | 254 | Public Works | 44 |
| Elected Officials | 5 | Military | 16 | Universtiy Personnel | 459 |
| Emergency Management | 51 | Mobilization Augment | 77 | Utilities | 45 |
| Fire & Rescue | 144 | Private Industry | 700+ | Volunteer Agencies | 125 |
| Health & Medical | 268 | Public Information | 13 | Total: | 3199+ |

Source: City of College Station Department of Emergency Management

The primary obstacle confronting rescuers was the large number of logs scattered about the accident scene. There were at least 5,000 logs in the collapsed stack and as many as 2,000 more scattered around on the ground. It was quickly determined that the only way to safely handle the logs was to remove them by hand, one at a time. A number of areas had to be stabilized, however, prior to the removal of any of the logs. The Bryan Fire Department USAR Team had agreements in place with a local builder's supply to furnish shoring materials for this purpose. These materials were brought to the scene by their vendor and were employed to enable the rescuers to safely access the victims pinned within the stack. When a victim was located, medical treatment was started even though the victim was still entrapped.

After the stack was stabilized, rescuers undertook the task of removing the logs from the stack. Once removed from the stack, student volunteers were utilized to haul the logs away from the scene. A large number of students, including members of the University's football team and the Corps of Cadets, pitched in to help with this process. The discipline of the Corps helped to make this an orderly event and, no doubt, prevented injuries to those involved in removing the logs. Several cranes were already at the site and Command requested that several additional cranes and forklifts be sent to the scene. The heavy machinery was used whenever it was determined to be safe to operate without disturbing the stack.

A chronology of key events is listed in Table Three, below. Rescuers were successful in removing two live victims from the stack, the last one being removed at 06:51 hours. As previously stated, listening devices and search cameras were used in an at-

tempt to located trapped victims. A number of K-9 teams were also on site, but did not play a major role in the search effort.

Table Three
Response Chronology

| 18 November, 1999 | |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------|
| <i>Time</i> | <i>Event</i> |
| 02:43 | First call to 911 |
| 02:48 | Mutual Aid request to Bryan |
| 04:05 | Emergency Management Coordinator notified |
| 04:15 | Brazos County EMC notified and DPS notified that their radios were operational |
| 04:20 | EOC activation |
| 04:25 | All key City staff members notified |
| 04:30 | Duty log started |
| 04:47 | City Manager notified Council Members |
| 06:05 | Three confirmed dead and recovered, six additional dead still entrapped. Two trapped are still alive. |
| 06:25 | 8-10 in rubble that appear dead, two trapped still alive. |
| 06:51 | One person pulled from rubble alive. |
| 08:33 | Requested FAA to restrict airspace around incident site |
| 08:37 | University President holds press conference. Confirms four dead and twenty-five people transported to area hospitals. |
| 09:01 | Requested silence in area in 15 minutes for a duration of 45 minutes in order to use listening devices. |
| 09:14 | FAA authorizes "no fly zone" for three nautical miles, 3,000 feet restricted area. |
| 14:15 | PIO confirms six dead, 25 taken to hospitals, ten treated and released |
| 15:27 | TAMU confirms death total now at eight |
| 17:00 | Confirmed that death total now at nine, two believed to still be in stack; 28 injured so far |
| 23:47 | Two remaining bodies will have to be removed by hand |
| 19 November, 1999 | |
| <i>Time</i> | <i>Event</i> |
| 00:03 | Official count is 26 injuries, 11 dead |
| 00:55 | Body of last known fatality being removed from stack |
| 02:14 | Last log removed, no other victims found |
| 02:20 | EOC deactivated |

Source: City of College Station Department of Emergency Management

The bonfire collapse produced a major media event. A number of helicopters from news agencies buzzed the scene and approximately fifty television satellite trucks congregated on the north side of the incident site. A number of the television stations broadcast most of the event live from the scene. Due to the noise, Command requested that the Federal Aviation Administration (FAA) establish a “no fly zone”. The downdraft from the helicopters also helped to stir up dust at the rescue site and interfered in the rescue and recovery effort.

Easterwood Airport is located just west of the campus near the Firemen’s Training Field. The FAA Tower is not staffed around the clock and was closed at the time of the collapse. The FAA in Houston was contacted and they established a 2,000-foot floor. When the Easterwood Tower became operational later that morning, the FAA expanded the zone to three nautical miles and 3,000-feet. At 09:00 hours, Command called for complete silence for a period of forty-five minutes to maximize the chance that the listening devices might find someone.

The third and final phase of the incident involved the recovery of the bodies of the deceased. Initially, it was estimated that the recovery efforts would take more than twenty-four additional hours due to the number of logs still on the stack. The process would have to progress slowly to prevent further collapse of the stack and every log would have to be removed to ensure that everyone had been accounted for.

The identification of the victims proved to be problematic, because many of the victims were not carrying any form of identification. Fortunately, the bonfire construction process had a strict accountability system in place and the “pots” in charge of the stack had a reasonably accurate list of the persons who should have been working at the time the collapse occurred. Tragically, many of the deceased suffered severe trauma and were not immediately recognizable. The work rosters assisted in the process of identification.

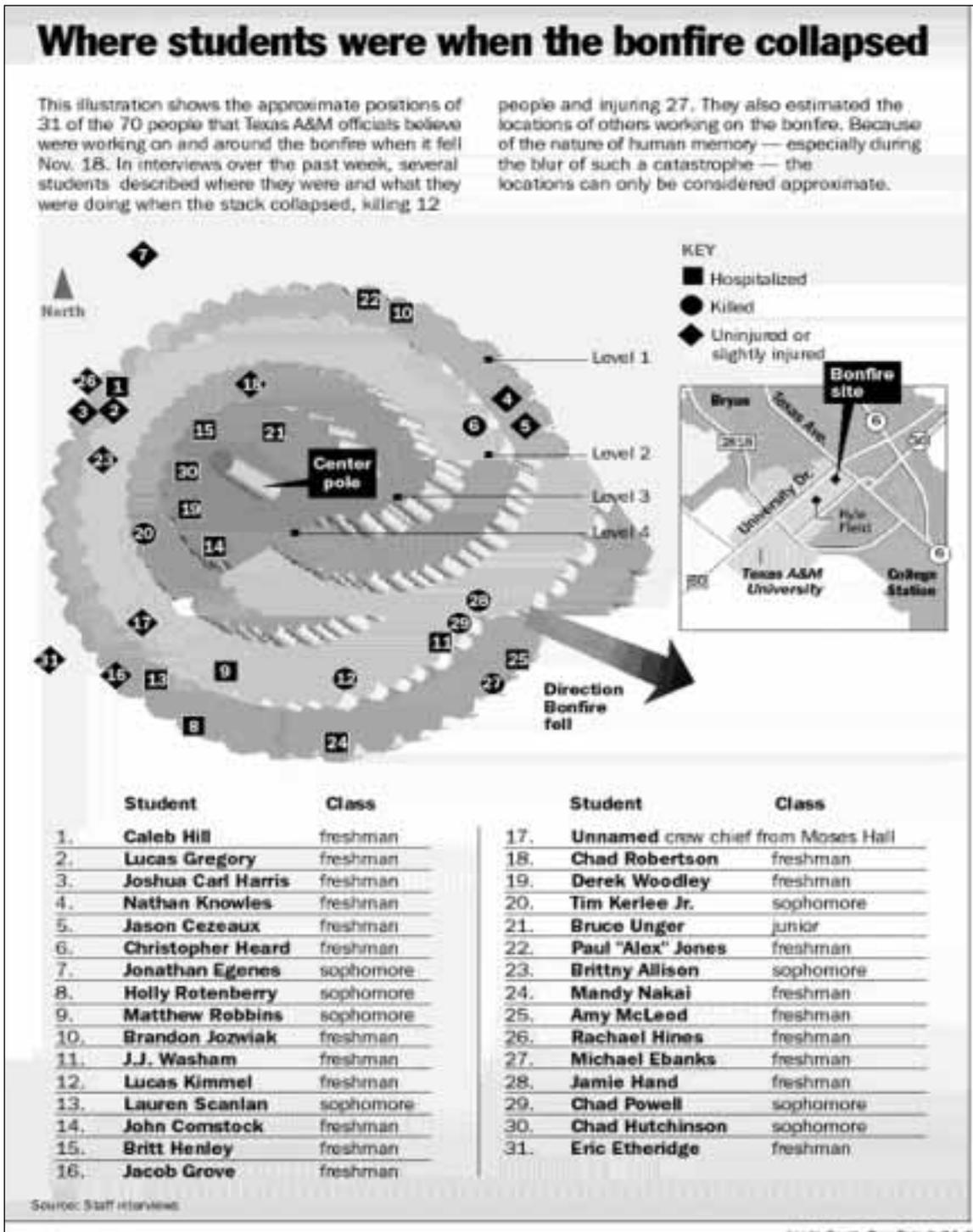
A temporary morgue was set up near the command post and was placed under the supervision of the University Police Department. Initially, several pieces of apparatus were formed into a “V” to shield the deceased from public view. Three sixty-passenger buses later replaced the apparatus. The Justice of the Peace responded to the scene and declared the victims to be dead after their bodies were removed to the temporary morgue. Once the police identified a body, it was removed in a funeral home vehicle and was taken to St. Joseph’s Hospital.

Although, the hospital does not have a formal morgue, there is storage capacity for up to four bodies. Needless to say, the number of fatalities far exceeded the hospital's limited capacity. The situation was compounded by requests from skin and organ banks to harvest useable organs and tissue from the deceased. It took a lengthy period of time for these agencies to arrive at the hospital. Therefore, these requests delayed the release of the bodies to funeral homes.

The grim task of removing the deceased began. The first body was removed from the top of the stack at 03:30 hours. Two more bodies were recovered on the east side of the stack at 04:00 hours and two bodies were recovered on the west side at 04:18 hours. Figure Five, below, provides an illustration of the approximate location where the dead and injured were found. The last body was not removed until 01:00 hours on Friday morning, the 19th of November. One of the students transported to the hospital later died, bringing the final death total to twelve.

Eleven of the people killed were students and one was a graduate of the University. Five of the students were freshmen, five were sophomores, and one of the deceased was a senior. Two of the victims were females and ten were males.

Figure Five
Location of Fatalities



Source: Austin360.com

Most counties in Texas do not have a medical examiner or coroner. Instead, an elected Justice of the Peace (JP) performs that function. All of the deaths were determined by the local JP to be the direct result of the trauma suffered during the initial collapse. Therefore, autopsies were not ordered because the cause of death was known and there did not appear to have been any criminal or suspicious act surrounding the collapse.

As previously stated, the collapse became a media event. At one time during the incident, more than fifty television satellite trucks, including several from Spanish speaking stations congregated on the scene. The University was able to provide interpreters to accommodate the media personnel who did not speak English. Several television stations interrupted their regular programming to carry the event live from the scene.

A media sector was established in a parking lot on the north side of event. A PIO team conducted regular briefings throughout the incident, with the first full briefing held at 07:00 hours on the morning of the 18th of November and regularly scheduled briefings took place throughout the remainder of the incident. Two still photographers and four video cameras were allowed into the perimeter to take pictures. They were required to share their photos and videotape with the other media agencies.

The large number of personnel assembled on the scene necessitated a massive rehab effort. A number of tents were set up around the site by military personnel to feed and rehab the rescue workers. An attempt was made to rotate personnel every thirty minutes to lessen the chance for injury. The University's food service, local restaurants and ordinary citizens all contributed to this effort. For example, at least four message therapists were on hand to help with tired and sore muscles. A large number of portable toilets were deployed at the scene as well. The College Station Parks and Recreation Department furnished tables, chairs, and ice chests. They also helped to establish shelters for the family members of the victims who responded to the scene to monitor the progress of the rescue effort.

The response by the community to the incident was overwhelming. Some one stated that you would ask for one item and you would get three. It was also reported that someone complained about being cold and approximately 500 sweatshirts appeared in short order. Whether the request was for food, chain saws, or some other item, it was always procured in abundance. Unfortunately, the donations at times overwhelmed the emergency responders. A number of would-be rescuer workers also showed up at the scene uninvited.

The Texas Forest Service also responded to the incident. The agency contacted the Texas Logging Council and requested that log-moving equipment be brought to the scene to assist with recovery efforts. Steely Lumber Company of Huntsville, located about one hour east of College Station, sent two logging machines and three equipment operators to the scene. Thanks to the skill of the operators and the capabilities of the equipment, the remainder of the stack was quickly dismantled, saving valuable time in the recovery effort.

The age of the deceased and the strong emotions and traditions surrounding the incident had a significant impact on the emergency responders. The duration of the incident, almost a full twenty-four hours, also increased the stress and frustration levels of those involved in the rescue and recovery efforts. Critical Incident Stress Debriefing teams were made available to emergency response personnel. Team members were supported in their efforts by area Chaplains and Ministers from the College Station Police

DEPARTMENT'S CHAPLAINS' PROGRAM

A demobilization team held four days of debriefing sessions following the conclusion of the incident. Some of the agencies involved, particularly the fire and rescue agencies, made attendance at a debriefing session mandatory. Other agencies did not. Debriefing was also made available to hospital personnel and the University's EMS providers.

The University has a Critical Incidence Response Team that coordinates efforts during any crisis related to the campus. The team is composed of four core members: the director and three associate directors from Department of Student Life. The team also has a representative from every department on campus. Numerous counseling sessions were made available to students and their families to help them cope with the grief associated with this event.

The effects of the bonfire collapse on the student body and the entire community have been profound. An orange plastic perimeter fence was erected after the incident to preserve the scene while the investigation was conducted. The fence was covered with flowers, letters, plaques, and other items in memory of the dead and injured. Countless notes of sympathy and encouragement were received from people throughout the country, including strong support from other universities within the State of Texas. In a very touching demonstration of devotion, more than a dozen coveted senior rings were left near the Administration Building on campus as offerings to the twelve who died in the incident.

Hundreds of people gathered at the site throughout the event to offer their prayers and support to the victims and their families. On Sunday November 21, 1999 a memorial service was held in the evening at Central Baptist Church in Bryan. The event was attended by over 1,800 including the Governor of Texas. The funerals for the twelve students were also emotional events and were attended by a large number of students, family and friends. In keeping with another tradition on the A&M campus, a Silver Taps ceremony was held to honor those who were killed in the collapse.

Silver Taps is held on the first Tuesday of each month, when necessary, to honor the death of a current student. The December 1999 ceremony took on special significance in light of the tragic events surrounding the 1999 bonfire collapse. The ceremony is conducted at the Albritton Bell Tower. During the ceremony, the Ross Volunteer's firing squad, a ceremonial drill team attached to the Corps of Cadets, fires a twenty-one-gun salute and taps is played from the dome of the Academic Building. Taps is repeated three times in each direction of the compass. It is not played, however, to the east because the sun will never rise again on deceased. The ceremony dates to 1898 and the death of College President Lawrence Sullivan Ross.

In the aftermath of the bonfire collapse, more than \$250,000 was donated to a number of funds that were established to memorialize the victims. The Bonfire Relief Fund was established to assist the families with expenses incurred as a result of the incident. The Bonfire Memorial Endowed Fund, administered by the Association of Form Students and The Texas A&M Foundation, was established to fund a permanent recognition of those who died in the accident.

A plethora of litigation often accompanies tragedies such as the bonfire collapse at Texas A&M University. While it too soon to know for sure, the pride and tradition surrounding A&M may very well dictate that events will be different this time. The parents of several of the students killed or injured when the bonfire collapsed stated publicly that they do not blame the University for the deaths of their children. Published reports also indicated that a number of the parents, as well as students who were injured in the collapse, believe that the bonfire tradition should continue and that they have no plans to sue the University.

Governmental liability is limited by the Texas Torts Claims Act, which places a limit of \$250,000 for an individual and \$500,000 per occurrence for claims against a government agency. The cap can be waived by the Legislature, however. No known litigation had been filed at the time that this report was compiled.

In spite of the size of the rescue effort surrounding the bonfire collapse, the College Station and Bryan Fire Departments still had to continue to provide fire and emergency medical service to their respective cities. One Engine Company and all four of Bryan's engine companies remained in service throughout the incident. During the height of the event, off-duty personnel were used to staff reserve apparatus and ambulances. After the first hour, the vast majority of the injured had been transported. Therefore, most of the ambulances were no longer needed at the scene and operations went back to an almost normal status.

THE CRITICS

Unfortunately, speculation often runs rampant after a significant event, particularly one as emotional as the collapse of the A&M bonfire stack. It was for this reason, that the University took the proactive step of appointing a special commission to review the collapse and to report its findings after an extensive and exhaustive study of the collapse.

For example, following the collapse, a number of individuals came forward with theories concerning why the collapse had occurred. The theorist included a former construction science professor at A&M who stated that he had worked for thirteen years on the bonfire and that important safety standards may have been ignored. Specifically:

- The stacks may have not been interlocked
- The tension on the guy lines might have been slackened
- Steel cables may not have been used on the bottom two tiers of logs to bind the stacks together

A former member of the class of 1977 who had participated in the construction of the bonfire while he was a student at A&M, remarked at a recent reunion of the Red Pots that he was concerned that there were not enough "core logs" on the stack. These logs are used early in the construction of the stack to provide stability. After the center pole is set, a ring of logs is placed in the ground approximately five to eight feet deep. The logs are pulled tight with a cable. A second group is constructed after the bottom ring reaches fifty-feet in diameter. The two rings make the stack stay up longer and cause the entire structure to be more stable.

His comments were e-mailed to the Vice-President of Student Affairs and was one of more than 2,000 documents related to collapse released in response to Open Records Requests following the collapse.

A report published in *The Houston Chronicle* (12-4-99) stated that in 1986, the University Safety and Health Officer suggested that the bonfire be reduced by ten feet in height and in diameter and that students work during day light hours rather than at night in order to “minimize the accident potential”. The Vice President for Student Affairs, however, suggested maintaining the fifty-five foot height because there had been no problems and no further action was taken on the recommendations.

THE INVESTIGATION

The President of Texas A&M University, in response to the tragic events surrounding the collapse of the bonfire stack, appointed a five member Commission of Inquiry charged with finding the cause of the collapse, as well as all other facets related to the incident. The Commission’s charge read in part:

To satisfy itself that the truth about what caused the accident is known as far as it can be discovered and to report its findings and conclusions with recommendations for corrective actions, if warranted.

Created as a fact-finding body, the Commission’s purpose was to ascertain the truth about the accident and was charged with the responsibility to focus on safety and training, engineering and design, soil and site conditions, materials and other factors of construction, transportation, and student leadership/development.

Leo Linbeck, Jr. was appointed as the Chairman of the Commission. He is the CEO of Linbeck Construction Corporation, a large Houston Construction Company and has a reputation for integrity and openness and has extensive experience in the construction industry. The other members of the Commission include Veronica Kastrin Callaghan of El Paso, a vice-resident of an industrial real estate company; Major General Hugh G. Robinson of Dallas, U. S. Army Retired, and a West Point Graduate with a master’s degree in civil engineering from MIT; Allan Shivers, Jr. of Austin, owner of a consulting and investment company and the son of a former Governor; and William E. Tucker of Fort Worth, the Chancellor emeritus of Texas Christian University. None of the members of the Commission have any direct tie to A&M.

Shortly after its creation, the Commissioner named two management consultants, neither with any ties to the University, to assist with their fact-finding mission. Employed by McKinsey and Company, the consultants coordinated the efforts of the

scores of experts that were utilized by the Commission during the conduct of their inquiry.

The University Police Chief, a retired FBI agent, described the investigation as a scientific inquiry rather than a criminal investigation. Shortly after the collapse, a consultant hired by the University stated that soil tests performed by his company after the accident found nothing unusual about the ground at the bonfire site. He further stated that a soil failure did not cause the collapse. Specializing in foundation evaluation and design, his company took four borings from near the spot where the center pole was sunk into the ground. In discussing the results of the tests, he compared the bonfire stack to a large grain silo, which typically is tall, heavy, but not too large in circumference.

More than 2,300 documents and photographs were released under the Texas Open Records Act, including photographs, which revealed the presence of beer cans and bottles at scene. One of the documents released was a December 9, 1999 memo from a professor of mechanical engineering appointed as the head of the A&M staff team to assist the commission in their inquiry. His memo stated that the bonfire stack, at the time of the collapse, was not forty feet as originally reported, but the four-tiered stack was already 59 feet high and had two more stacks to go before being completed.

His memo to the Commission reported the height, which does not include the seven-foot outhouse on top, as being eighteen feet on the first tier, sixteen feet on the second, fourteen feet on the third, and eleven feet on the fourth. The fifth tier was designed to have been nine feet and the sixth is typically four to five feet in height. Therefore, the completed height would have been just over seventy feet, rather than the fifty-five foot standard set by the university. He cautioned, however, against drawing any conclusions from this revelation.

The Texas Rangers offered the Department of Public Safety's laboratory to assist with the inquiry, but indicated that the agency would not investigate the incident since it was not a criminal matter. OSHA, however, sent their regional investigators to examine the site. The agency is required by law to investigate accidents involving privately owned heavy equipment and there were several cranes at the scene, which were owned or leased by private companies.

In a related incident, the local newspaper (*The Eagle* 12-3-99) reported that a student with more than 200 hours of experience operating a crane was one of two drivers on-duty when the collapse occurred according to documents released by the University.

It is a violation of the student-written Bonfire Handbook, but not of A&M policy, for a student to operate heavy equipment at the site. The State of Texas, however, does not have a set of rules governing who can drive a crane, according to the National Commission on Certification of Crane Operators based in Fairfax, Virginia. OSHA also does not require a license for the type of crane that was being used by the student.

The use of alcohol was a theme discussed throughout the investigation in relationship to the bonfire collapse, particularly after the disclosure that empty containers were found and photographed at the scene of the collapse. Two of the students killed in the collapse were alleged to have been intoxicated at the time of their deaths according to toxicology tests released to the media. The revelation prompted the Texas Alcoholic Beverage Commission (TABC) to start its own investigation into the incident because one of the deceased was a minor. According to the TABC, the investigation was primarily intended to be a “source investigation” to determine where the minor acquired the alcohol.

The legal limit in Texas is .08. One of the deceased allegedly tested at .316, or almost four times the legal limit. The other deceased student allegedly tested at .161, or twice the legal limit. According to published reports, the tests disclosed that the former student killed in the collapse also has a small amount of alcohol in his system at the time of death. Eight of the deceased, however, did not have any traces of alcohol in their system and the test results on the twelfth victim were not available.

An article in the local paper on December 18th, however, reported that a second toxicology report found lower levels of alcohol in the two deceased students than the first test. The second tests were conducted by orders of the Justice of the Peace and were intended to confirm the results of the first tests. Private companies performed both tests, the first by a firm located in Irving, Texas and the second by a firm located in Pennsylvania. Officials declined to disclose the results of the second tests, but a family friend of one of the victims disclosed that the second test indicated a result of .09 rather than .316 as was alleged by the first test. The rescue workers reported smelling alcohol on both of the deceased students, which promoted the Justice of the Peace to order the tests. The toxicology reports were taken from vitreous fluid, a jellylike substance taken from the victim’s eyes, and not from the victims’ blood.

Only one of the twenty-seven students injured in the collapse had a blood test performed on them. This fact was discovered in response to TABC’s subpoenas served at the two hospitals. College Station Medical Center reported that the hospital did not perform any toxicology exams to determine alcohol content. State law does not require

testing unless law enforcement officials request a test to be performed. A test was performed on a nineteen-year old student taken to St. Joseph's. Test results indicated that there was a trace amount of alcohol present.

Bonfire night is typically one of the most active nights of the year for Brazos County Law Enforcement Agencies because of the large number of parties and activities associated with the event. Those who work on the bonfire are required to sign a pledge card promising that they will not drink and get on the stack, but there is a history of alcohol related problems. As early as 1985, students blamed drinking as a contributing factor for bonfire related injuries. Since the activity is a student function, university officials rely upon the students to enforce the rules.

Over the years, a number of injuries such as allergic reactions to the pine trees, crushed hands, teeth knocked loose, and cuts from mishandled axes have been reported. There have also been complaints about the way women are treated during the event, particularly during the 1987 and 1988 bonfires. The alcohol related statistics compiled by the local law enforcement agencies are reported in Table Four, below.

Table Four
Alcohol Related Incidents

Following the collapse, the Justice of Peace ruled that the cause of death for all

| Year | Arrests | Citations |
|-------------|----------------|------------------|
| 1994 | 22 | 62 |
| 1995 | 19 | 118 |
| 1996 | 18 | 55 |
| 1997 | 5 | 59 |
| 1998 | 18 | 73 |

twelve victims of the bonfire collapse was accidental. Therefore, he did not order autopsies to be performed on the bodies of the deceased. With the exception of large metropolitan counties, most counties in Texas do not have a Medical Examiner or Coroner. A Justice of the Peace, by law, performs the function of corner. Each county has a minimum of four JPs and their jurisdictions coincide with the boundaries of the county commissioners' precincts. In more densely populated counties, however, the number of JP's may be increased to a maximum of eight.

On May 2, 2000 the Special Commission on the 1999 Texas A&M Bonfire released its final report. Compiled at a cost of approximately \$2 million, the report revealed that:

The 1999 Bonfire collapsed due to a number of both physical and organizational factors. Structurally, the collapse was driven by a containment failure in the first stack of logs. Two primary factors caused this failure: the first was excessive internal stresses driven primarily by aggressive wedging of second stack logs into the first stack. The second was inadequate containment strength. The wiring used to tie the logs together provided insufficient binding strength. Also, steel cables, which in recent years had been wrapped around the first stack, were not used in 1999, further reducing containment strength. These two factors - excessive internal stresses and weakened containment strength - combined to cause the collapse.

The physical failure and causal factors were driven by an organizational failure. This failure, which had its roots in decisions and actions by both students and University officials over many years, created an environment in which a complex and dangerous structure was allowed to be built without adequate physical or engineering controls.

This organizational failure is complex but includes such things as the absence of an appropriate written design or design process, cultural bias impeding risk identification, and the lack of a proactive risk management approach.

The Commission's report determined that the weather was not a contributing factor in the collapse. It had not rained in the days leading up to the collapse and the sky that morning was clear and the temperature fluctuated between 40 and 50(F. The wind direction was from the south/southeast with a speed of five to seven miles per hour with no gusts. The report also ruled out sabotage or any criminal activity.

Two investigations were on going at the time this report was prepared. The Texas Board of Professional Engineers, a nine-member board based in Austin, continues to research two issues. First, the Board intends to determine whether or not administrators and the University violated the law by their failure to involve professional engineers in the project. Second, the Board is considering whether engineers on the faculty ignored their ethical duty by failing over the years to raise concerns about the bonfire structure.

The College Station Police Department is also continuing its investigation of the collapse, which is a matter of course following an unnatural death. Police are charged with determining whether any criminal activity was involved and they are seeking to determine if any crimes were committed related to negligence. In addition, police wish to determine if there was any violation of the Texas Engineering Practice Act of 1937. The Act was created

to protect public safety by regulating the design and construction of buildings and other structures. Provisions of the Act require that any public work costing more than \$8,000.00 be designed and supervised by a licensed professional engineer. The exact amount expended on the construction of the 1999 bonfire has yet to be determined.

AFTERMATH

Following the release of the Special Commission report, the President of the University announced a number of changes that were intended to resolve the issues identified by the Commission and to prevent future tragedies. The President suspended the annual bonfire until at least 2002 and recommended the following schedule:

- **2000 and 2001:** no bonfire construction
- **September 2000:** Working group comprised of students, staff, and faculty to be created to plan for the 2002 bonfire
- **November 2000:** A memorial event to be held to honor the students killed by the 1999 collapse
- **April 2001:** Bonfire plan to be submitted by working group
- **May 2001:** Bonfire plan scheduled for approval
- **September 2001:** Begin implementation of working group plan
- **November 2001:** Groundbreaking or dedication of permanent memorial for deceased students
- **January 2002:** Begin work on 2002 bonfire
- **November 2002:** Bonfire

The President also recommended a number of other changes in response to the Commission's findings. Among the recommendations were:

- The use of a more stable, single-tier "teepee" design, which was used in the 1950's
- The use of lumber delivered to the campus instead of logs cut by students
- The bonfire will follow a formal design crafted and overseen by professional engineers, which will include supervision and inspection of the construction process
- Students must follow the design and may not make alterations
- The bonfire will be overseen by a cadre of professional, adult supervisors who will instruct and tell student leaders how the structure should be built
- Students will undergo formal training
- All-night student building shifts will end and may not work past midnight
- There will be adult supervision and a crackdown on drinking

In response to the President's directives, a twenty-member steering committee is overseeing six subcommittees charged with organizing and planning the 2002 bonfire. The six subcommittees include a Safety Task Force, a Risk Management Task Force, a Student Leadership and Participation Task Force, a Design and Construction Task Force, a Vision for Student Leadership Task Force, and an Institutional Culture Task Force. The steering committee is expected to submit a report to the University President in April 2001.

LESSONS LEARNED

1. The bonfire collapse reinforced the need for pre-incident planning and the necessity for developing and exercising emergency management plans.

Some people described the bonfire collapse as a freak accident, which was certainly not on anyone's radar screen. Nevertheless, it happened. Fortunately, the local jurisdictions had an up-to-date emergency management plan that had been regularly exercised. There was a strong commitment by the local governments' management teams to emergency planning and the event demonstrated to the agencies involved that what they had been practicing worked. Furthermore, the incident not only demonstrated the value of planning, but also the value of sharing resources and interagency cooperation.

The need to play like you practice was also demonstrated by the incident. Given the number of deaths, injuries, and resources that were utilized to resolve the incident, local authorities would have been overwhelmed if they had not had a functional plan in place. Certainly, very few communities have bonfires of the size and significance of A&M's. The reality is, however, that very few communities have access to the volume and type of resources required by many of the potential incidents that could occur in their own community.

Therefore, planning becomes even more important in these situations. The time to identify potential sources and the availability of resources is before an event occurs. Additionally, emergency management plans should be evaluated and revised following an incident. One particular facet of the local plan that was identified as needing improvement in this incident was the management of volunteers and donations. The number of people that showed up to help without being requested challenged local officials.

The sheer volume of donations that were received was equally challenging. On a positive note, however, a number of agencies and individuals called the EOC from all over the region and offered their assistance, but fortunately did not respond to the scene without being requested. It can be beneficial for agencies to notify an agency experiencing a major event about the availability of resources that might have been overlooked during the planning process. Local officials can then make a determination if those assets need to respond to the incident.

No amount of planning, however, can prepare an agency for the strange phone calls that seem to come as the result of a disaster. During the search and rescue effort, which was

being televised live in many areas, a psychic called and told officials that they were searching in the wrong area. The psychic continued by asserting that live victims would be located in another area of the stack. What do you do? If the psychic was correct, but ignored, there might have been significant ramifications. On the other hand, do you quit doing what you believe to be the right thing? In this instance, the psychic was wrong and the local officials made the correct decisions.

2. An adequate and reliable Communication System is essential during a large-scale event.

Fortunately, the primary response agencies had radio systems that were interoperable. Even so, the volume of radio traffic generated in a disaster will often congest many systems, at least for a time. In this event, the public telephone system was also severely taxed when the University requested that all of the students call home to reassure their worried parents that they were okay. The situation was both good news and bad news at the same time. Certainly, the positive side of the equation is that many fears were relieved and the calls home no doubt prevented some people from getting in their cars and driving to the University, which would have increased congestion and heightened anxiety. The downside, of course, was that the public telephone system could not handle the volume of calls that were being made.

Many of the calls were placed on cellular telephones at a time that emergency responders were also attempting to use cellular phones. As a result, the cellular system was also overloaded. Officials should consider this problem during the pre-incident planning phase and work out a plan to have the local cellular provider respond to the scene early in the event to take control of their systems and to give priority airtime to emergency responders. Cellular companies may be able to make caches of cellular phones available to emergency responders for use during an incident.

3. Think big-scale down.

The task, which confronted the first emergency responders on the scene, was initially very challenging. A similar incident of this magnitude may exceed the resources of many jurisdictions. Therefore, additional resources should be immediately summoned in order to speed their arrival and to insure that sufficient resources will be available to manage an incident. The incident commander should “think big”, i.e. think in terms of the worst-case scenario when ordering additional resources. If the resources are not needed, it is then possible to “scale down” the response.

There are so many decisions that have to be made by the incident commander and so many people demand time and attention, that many of the resources, which are used on a daily basis, may be overlooked. For example, helicopters from a television station can be used for aerial reconnaissance. Videotape can be made while in the air and taken back to the command post and reviewed on a television and VCR. Additionally, a neighboring department might have heavy rescue vehicles that could be sent to the incident or the local country club might loan their golf carts to assist in a prolonged incident of this type.

If the incident is going to take awhile to resolve, it might be advantageous to have electric power and hardwired telephone lines brought to the command post as was done in this incident. At least two telephone lines are desirable, one for incoming calls and one strictly for out going calls. Flashlights, maps, copiers, fax machines, batteries and battery chargers are also essential tools if the incident lasts very long.

4. An event involving multiple casualties can quickly exceed the capabilities of local medical facilities.

In some areas within the United States, regulations in the national health care system has resulted in a significant percentage of the available number of beds in many hospitals being occupied much of the time, particularly during peak periods of the cold and flu season. Therefore, bed space, particularly for critical care patients, might be at a premium. In the event of a large-scale incident that involves a large number of casualties, some thought should be given to redirecting non-critical patients to other facilities, particularly if the incident occurs late at night or during the early morning hours when the hospital staffing is minimal. There are a number of methods to accomplish this, including the use of helicopter ambulance services to transport patients to other facilities in neighboring cities.

If a large number of patients are to be sent to a specific hospital, it may be necessary to send additional personnel to assist the hospital staff with the unloading of patients and to assist in the emergency room as directed by the hospital staff. The influx of a large number of patients will also strain a hospital's telephone system and may result in a large number of friends and family members descending on the hospital to ascertain the welfare of their relatives. Additional personnel might prove to be useful in managing such an occurrence and may also assist in the effort to keep track of the location and condition of individual patients.

There is always a lot of confusion concerning the identification of victims in any disaster. The absence of identification on many of the victims compounded the problem in

this situation. The University's EMS service sent supervisors to each hospital and helped to keep track of the victims during this incident. In so doing, they were able to reduce the number of rumors that were quickly spreading throughout the community and helped to relieve tensions.

5. The incident reinforced the necessity of a strong incident management system.

Fortunately, the fire departments involved in the incident used a standardized incident management system. Many agencies may not use any type of command system or may not be familiar with how the fire department's system works. An incident is not the time to attempt the familiarization process. Equally important, is the ability to switch from managing an incident to managing a disaster. The following are items that might be considered:

- The highest-ranking officer does not always need to be the incident commander, but might actually be more useful at the EOC or in the field serving as a liaison officer with the other agencies involved in an event.
- An incident management system should include procedures on securing the scene, limiting access to the scene, and providing a means to identify responders by their function.
- The layout of an operation evolves as the incident develops. The pre-incident planning process should include the development of plans for laying out an operation, which takes into account the proximity to resources. A planning officer, with an aid, is often a useful position to appoint during a prolonged incident as well as an official photographer to record key events.
- Unified command is essential and representatives from every agency involved need to remain in the command post throughout an event and should be replaced whenever they leave. It is equally important in the EOC.
- The record-keeping function is important, not only in the command post, but in the EOC as well as staging and the other sectors.
- All positions within the command structure need not be fire personnel. Individuals from other agencies, even those involved in non-emergency functions, are often capable of fulfilling these functions.

6. An organization learns a great deal about itself and its members during a disaster.

The members of an organization often wonder why things are done a certain way. A disaster often reveals the real reason for doing things a certain way. Likewise, a disaster can be a catalyst for profound organizational change. The post incident critique process provides an opportunity to evaluate the organization, its mission, and its effectiveness and to correct any deficiencies that may be identified.

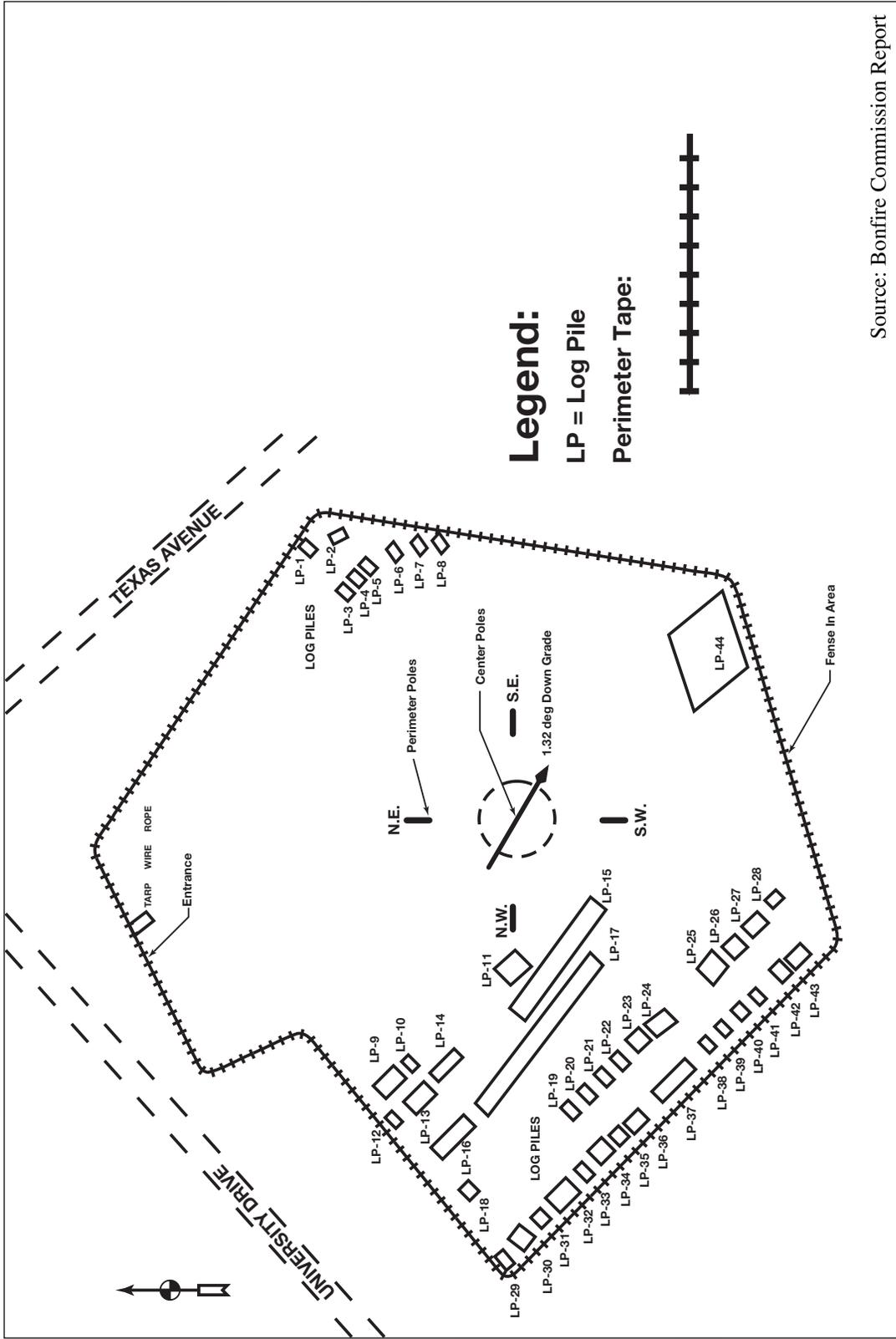
APPENDICES

- Appendix A: Maps
- Appendix B: List of Photos
- Appendix C: Bonfire Facts
- Appendix D: List of Participating Agencies
- Appendix E: List of the Deceased
- Appendix F: Executive Summary of the Final Report of the Special Commission on the 1999 Texas A&M Bonfire

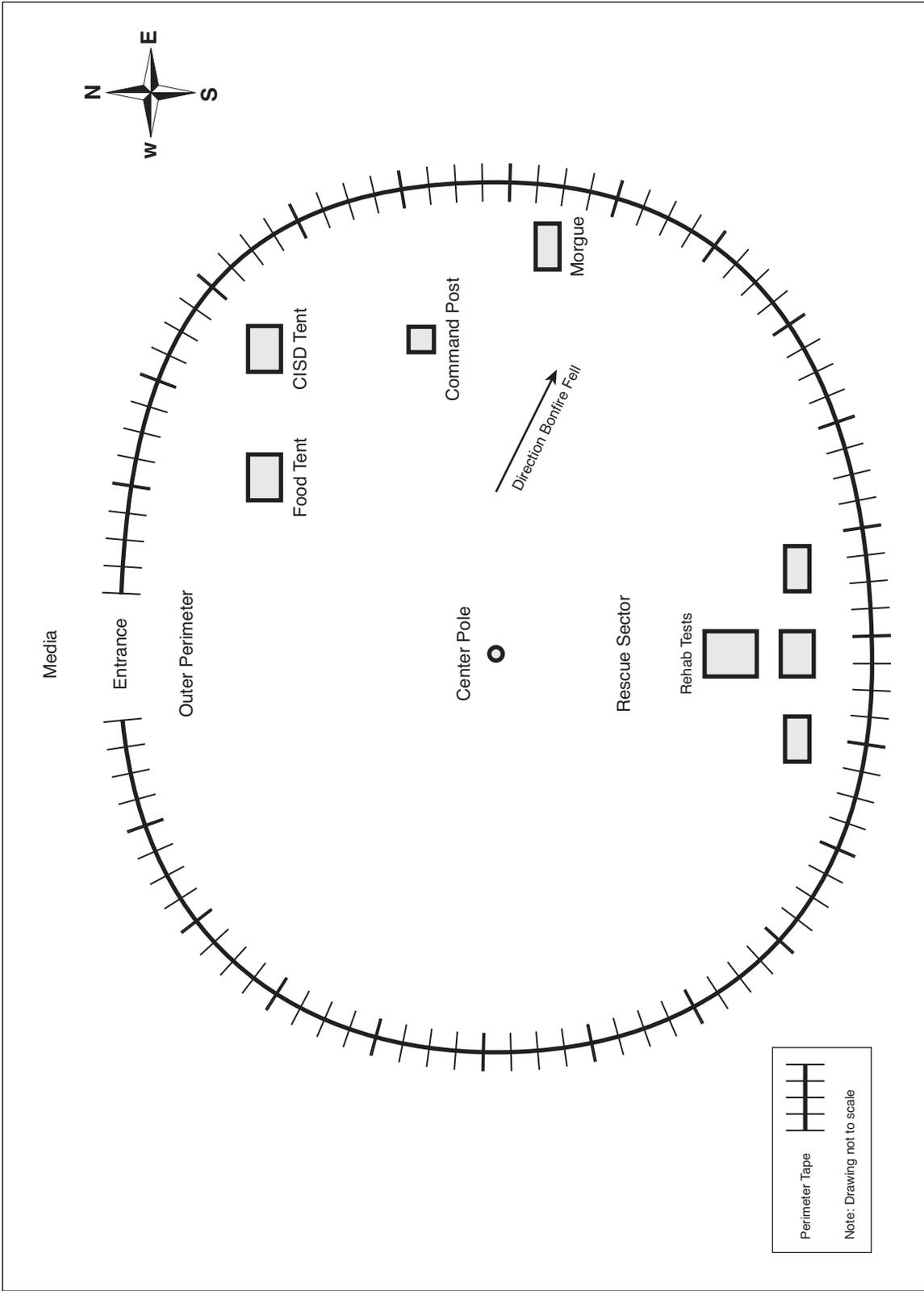
APPENDIX A

Maps

- Map #1 Bryan-College Station
- Map #2 University Campus (red dot indicates Bonfire Site)
- Map #3 Site Plans



Source: Bonfire Commission Report



APPENDIX B

Photos



1. Rescue workers look for victims



2. Rescue workers in food tent



3. Rescue workers look for victims



4. Candle light vigil



5. Knuckle boom loader removes logs



6. Day light recovery operations

APPENDIX C

Bonfire Facts

Source: Office of University Relations Texas A&M University

Growth

| | |
|------|-----------------------------------------------------------------------------------------------|
| 1909 | First bonfire consisted of trash gathered on the spur of the moment |
| 1912 | Lumber for construction of Milner and Legett dorms “acquired” |
| 1928 | First known photograph, which shows wooden pallets, tree limbs, etc. |
| 1935 | A farmer’s log barn is “acquired”, College Station then decided to take charge of the bonfire |
| 1936 | First Bonfire of “non-stolen” material. Wood from site of Easterwood Airport |
| 1943 | 25 feet tall, first all-log bonfire, depicted in the movie We’ve Never Been Licked |
| 1945 | First center pole, all log construction, teepee configuration, and topped by an outhouse |
| 1947 | First splice center pole, 50 feet tall |
| 1949 | 65 feet tall |
| 1954 | 73 feet tall |
| 1969 | 109 feet, 10 inches tall |
| 1970 | Size limited by University to 55 feet tall, 45 feet wide |

- 1978 Wedding cake design
- 1999 The 89th to be burned, the 90th built, or the 92nd if you count rebuilding the one in 1957 and the one in 1994

Construction

- Work Hours: estimated at 125,000
- Logs: estimated at 6,000 to 8,000 wired together
- Workers: approximately 5,000 will help in some way
- Fuel: 700 gallons of diesel fuel applied by the Texas Engineering Extension Service Fire Training School
- Timeline: “Cut” started on October 3
- Center pole: Arrived October 30
- Raised: Center pole raised on November 6
- Stacking: Takes two to three weeks

Manpower Coordination: Red Pots

- Center pole: Two telephone poles spliced together, 10 feet into ground, 55 feet above ground
- Outhouse: The t.u. tea room or frat house, previously “acquired” when there were plenty from which to choose. The responsibility is that of the Band and its sophomores. They have to build it now.
- Sign: “Austin” highway sign previously “acquired”, now donated by someone from Hearne. Traditionally lists the sophomore class year as the miles to Austin.

Stacks: Six. The 5th is wired together by junior red pots the day before Bonfire; the 6th is wired together by senior red pots the day before Bonfire.

Safety: All workers have to go through safety training.

Land: The logs are donated by landowners that need their land cleared.

Equipment: H. B. Zachary Construction Company in San Antonio, Young Brothers, Lone Star Trucking, FFE Trucking, Erwin-Wenglar Company, Prater Equipment.

Pots and Other Designations

Prior to 1967, the yell leaders were in charge, but in 1967, the Red Pots came into being and the construction and leadership tasks became formalized.

Red Pots In charge. 9 seniors and 9 juniors. The one in charge is the “Head Stack”. The 1999 head stack was Blaine Lewis, Class of 1999.

Brown Pots 3 Corps, 2 Civilians: they are responsible for supplying the labor.

Yellow Pots Dorm leaders

Women’s Provide lunches, water, etc. at the cut site
Bonfire
Committee

Reload Crew Supplies cookies, hot chocolate, etc. to workers.

Fish Stripe A white stripe around the pant leg of first-year workers

1998 Advisor Rusty Thompson, associate director, Memorial Student Center

Other Items of Interest

- University of Texas attempted to set the Bonfire on fire early on several occasions

- 1933 and 1948 dropped fire bombs from airplanes
- 1956 planted explosives and others, none succeeded
- University of Texas used to have a bonfire (trash), but gave up when they saw that they could not complete
- U.T. tradition now is to light red candles in order to “put a hex on the Aggies”
- 1979 - First females at the cut site
- 1963 - Not ignited because of the death of President Kennedy (Class of 1964 seniors was invited to participate in the lighting of the 1994 Bonfire at the invitation of the Class of 1994.
- 1957 - Had to be rebuilt in two days because it collapsed
- 1994 - Had to be rebuilt in less than a week because of a collapse due to wet ground.
- Crowd: - 30,000 to 70,000 in various years
- 1955: - Moved from Simpson Drill Field (in front of the Memorial Student Center) to Duncan Field (there for 37 years). Moved to Polo Fields in 1992.
- Elephant Walk: - Seniors gathered at Kyle Field (football stadium) at 13:38 Tuesday to wander around the campus like elephants seeking a place to die because their usefulness to the 12th Man is about to end. They hold mini yell practices at several locations before finally arriving at the Bonfire site.
- 1999 Elephant Walk: - 99 minutes after noon on Tuesday before Bonfire. Seniors go to Kyle Field to Bonfire site; juniors go from Bonfire site to Kyle Field.
- Replant: - New Aggie Tradition, each spring 10,000 trees are planted by more than 50 Aggie Student Organizations to show Aggie support for both Bonfire and the environment. This started in 1991.

APPENDIX D

List of Participating Agencies

Source: City of College Station, Texas Department of Emergency Management

Brazos County

- Emergency Management
- Justices of the Peace
- Sheriffs Office

City of Bryan

- Emergency Dispatch (911)
- Emergency Management
- Fire/EMS
- Police Department
- Risk Management
- Stress Management Team

City of College Station

- Administration
- City Council
- Development Services
- Economic and Community Development
- Emergency Dispatch (911)
- Emergency Management
- Fire/EMS
- Fiscal Services
- Human Resources
- OTIS/MIS
- Parks and Recreation
- Police Department
- Public Communications and Marketing
- Public Utilities
- Public Works

Hospitals

- College Station Medical Center
- Saint Joseph's

State of Texas

- Army National Guard, 4-112th Armor
- Department of Public Safety
- Department of Transportation
- Division of Emergency Management
- Stress Management Teams
- USAR Task Force One

Texas A&M University

- Corps of Cadets
- Emergency Care
- Emergency Medical Services
- Food Services
- Physical Plant
- Police Department
- Public Relations
- Safety and Health Office
- Student Life
- Texas Engineering Extension Service, Fire Protection Training Division
- Texas Forest Service

Other

- American Red Cross
- Austin Police Department Search and Rescue K-9 Unit
- Galveston GIS
- Local Businesses, Churches, Restaurants, and General Population
- Mutual Aid Fire Departments
- R.A.C.E.S.
- Salvation Army
- Steely Lumber Company
- Stress Management Teams
- Texas Logging Council
- U.S. Army Reserve, 420th Engineering Battalion

APPENDIX E

List of the Deceased

| Name | Hometown | Classification |
|---------------------------|-----------------------|-------------------------|
| Miranda Denise Adams | Santa Fe, | Texas Sophomore |
| Christopher D. Breen | Austin, Texas | Graduate: Class of 1997 |
| Michael Stephen Ebanks | Carrollton, Texas | Freshman |
| Jeremy Richard Frampton | Turlock, California | Senior |
| Jamie Lynn Hand | Henderson, Texas | Freshman |
| Christopher Lee Heard | Houston, Texas | Freshman |
| Timothy Doran Kerlee, Jr. | Bartlett, Tennessee | Sophomore |
| Lucas John Kimmel | Corpus Christi, Texas | Freshman |
| Bryan a. McClain | San Antonio, Texas | Freshman |
| Chad A. Powell | Keller, Texas | Sophomore |
| Jerry Don Self | Arlington, Texas | Sophomore |
| Nathan Scott | West Bellaire, Texas | Sophomore |

*Note: Male = 10, female = 2
Freshman = 5; Sophomore = 5, Junior = 0; Senior = 1; Graduates = 1*

APPENDIX F

Executive Summary of the Final Report
Special Commission on the 1999 Texas A&M Bonfire
May 2, 2000

INVESTIGATION PROCESS OVERVIEW

Immediately following the bonfire collapse on November 18, 1999, the Texas A&M Administration asked Mr. Leo Linbeck, Jr., from Houston to chair an independent Special Commission to investigate the tragedy. The charter of the Special Commission was to determine what caused the bonfire to collapse. Mr. Linbeck agreed, and subsequently asked four other individuals: Ms. Veronica Callaghan from El Paso, Mr. Hugh Robinson from Dallas, Mr. Alan Shivers, Jr. from Austin, and Dr. William Tucker from Fort Worth, to join him on the Commission. All of these individuals also agreed.

To complete their task, the Commission selected several teams, each charged with a specific area of analysis. Dr. Rex Paulson of Fay Engineering led Team One, which focused on understanding and evaluating historical bonfire design. Dr. Tape Carlson of Pack Engineering led Team Three in investigating the physical aspects of the collapse. Dr. Carlson was assisted by Wood Advisory Services, Inc., McBride Ratliff and Associates, A. C. Engineering, and Dr. Raymond Krizek of Northwestern University. Additionally, the Commission engaged several outside engineers to provide peer reviews of all the engineering work. Mr. John Fowler, Dr. German Gurfinkel, Dr. Monte Phillips, and a team from Haag Engineering - Mr. Jim Wiethorn, Mr. John Stewart, and Mr. David Teasdale - all provided review and comment on the engineering reports.

The analysis of both past and present bonfire organizational and behavioral issues was combined into one team (Team Two/Four), which was led by Mr. Kerry Johnson and Mr. Craig Clapper of Performance Improvement International. Finally, J. Kieffer of Kroll Associates lead Team Five, which conducted interviews, coordinated document and data collection, and investigated the effects of external factors on the bonfire.

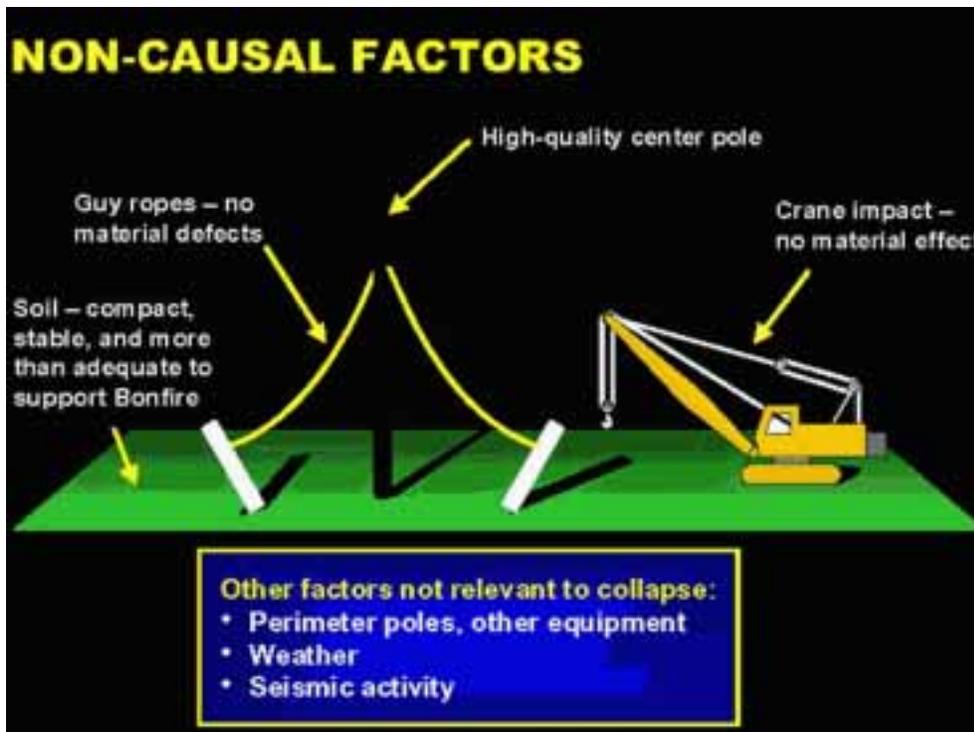
These teams and individuals have examined all of the main aspects of the 1999 bonfire collapse and have come to some firm conclusions.

SUMMARY OF FINDINGS

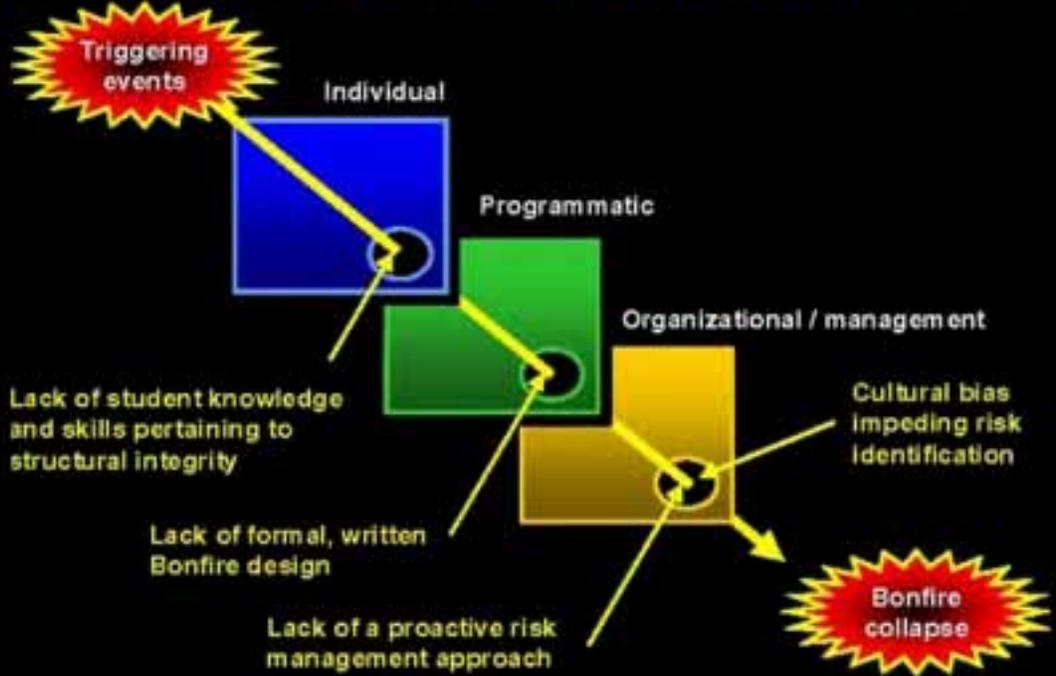
The 1999 Bonfire collapsed due to a number of both physical and organizational factors. Structurally, the collapse was driven by a containment failure in the first stack of logs. Two primary factors caused this failure: the first was excessive internal stresses driven primarily by aggressive wedging of second stack logs into the first stack. The second was inadequate containment strength. The wiring used to tie the logs together provided insufficient binding strength. Also, steel cables, which in recent years had been wrapped around the first stack, were not used in 1999, further reducing containment strength. These two factors - excessive internal stresses and weakened containment strength - combined to cause the collapse.

The physical failure and causal factors were driven by an organizational failure. This failure, which had its roots in decisions and actions by both students and University officials over many years, created an environment in which a complex and dangerous structure was allowed to be built without adequate physical or engineering controls.

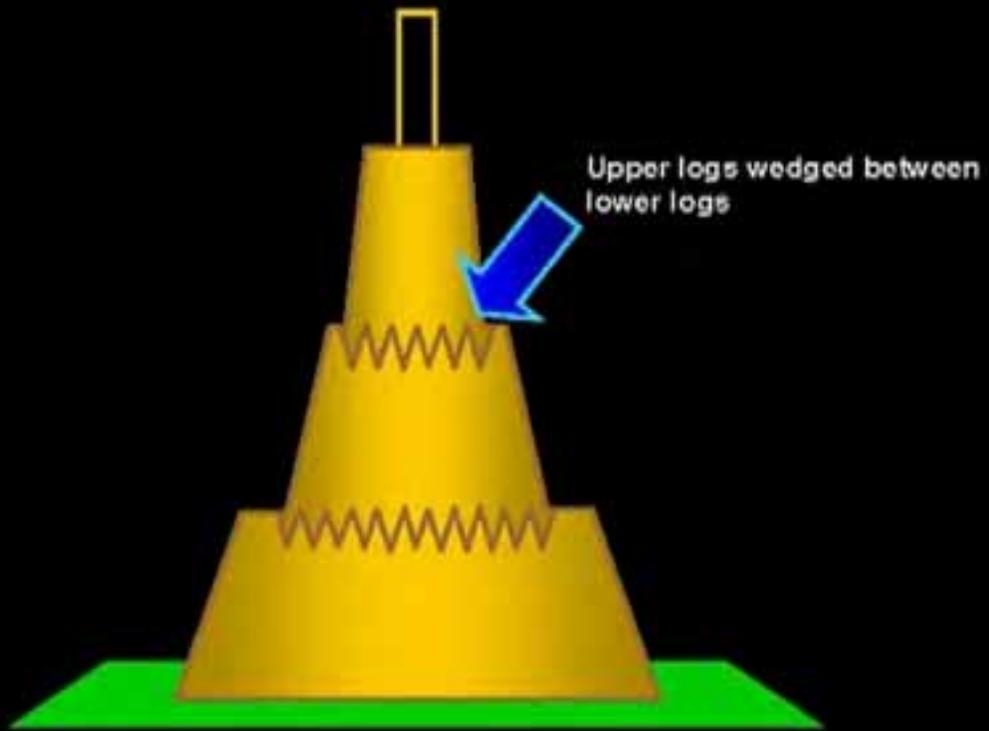
This organizational failure is complex but includes such things as the absence of an appropriate written design or design process, cultural bias impeding risk identification, and the lack of a proactive risk management approach.



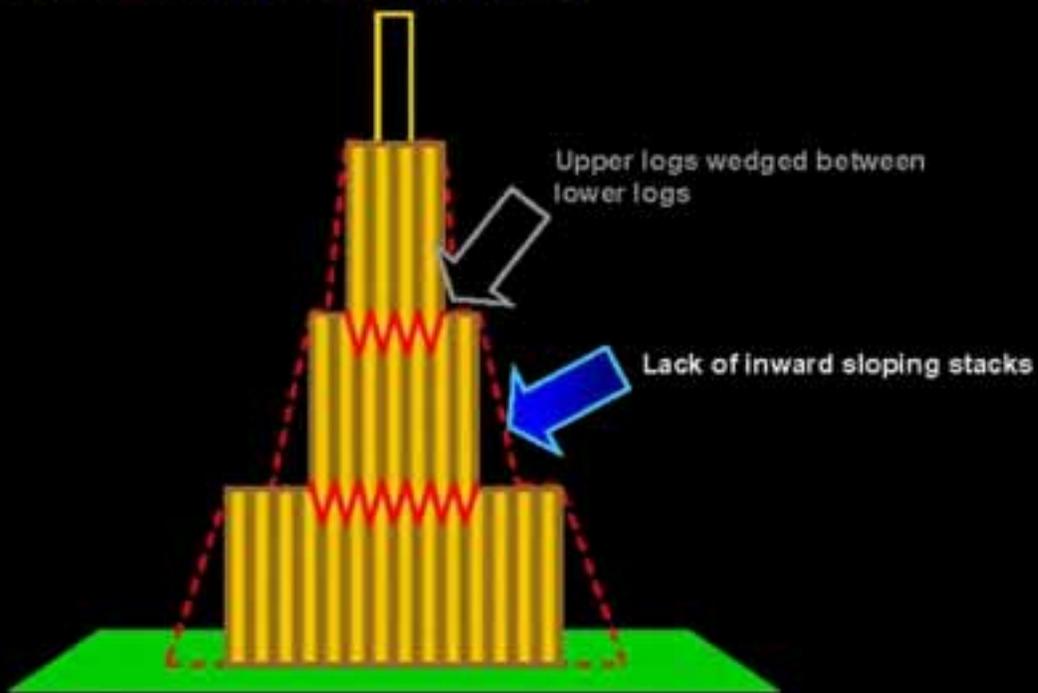
FAILURES RELEVANT TO COLLAPSE



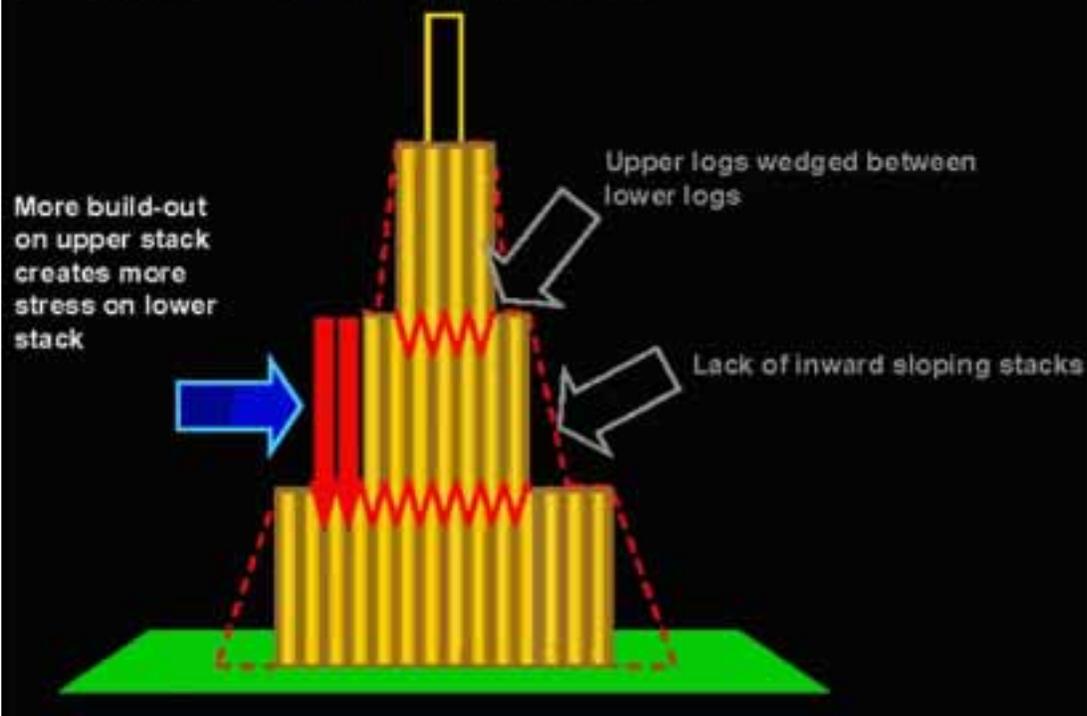
WEDGING EFFECT



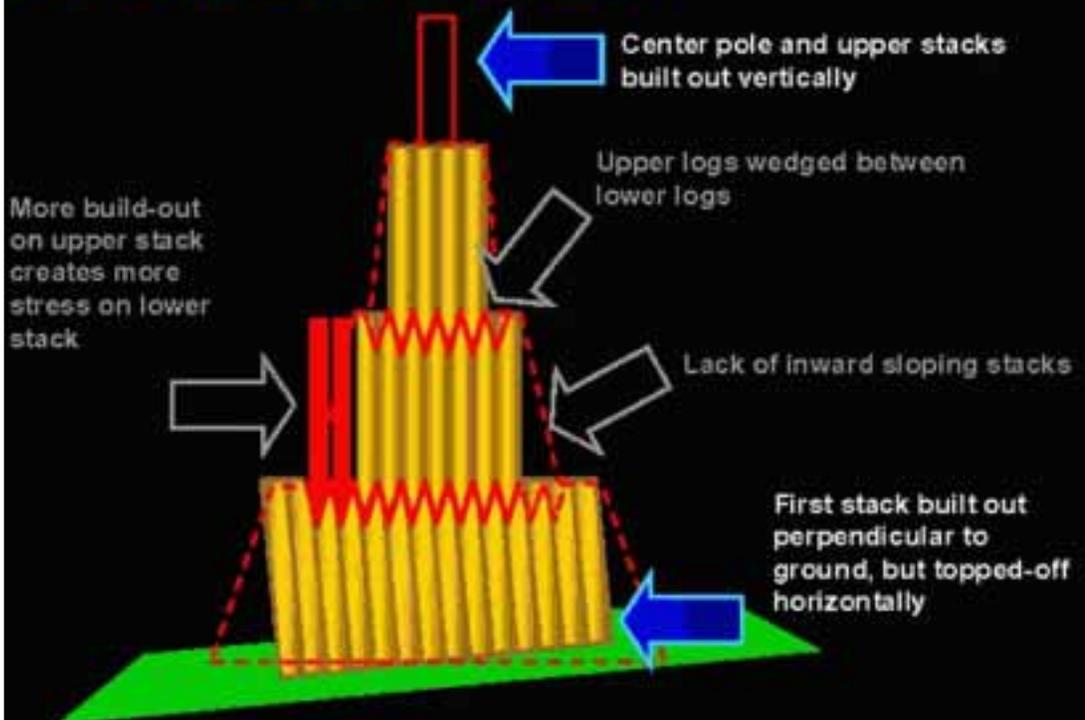
VERTICAL LOG EFFECT



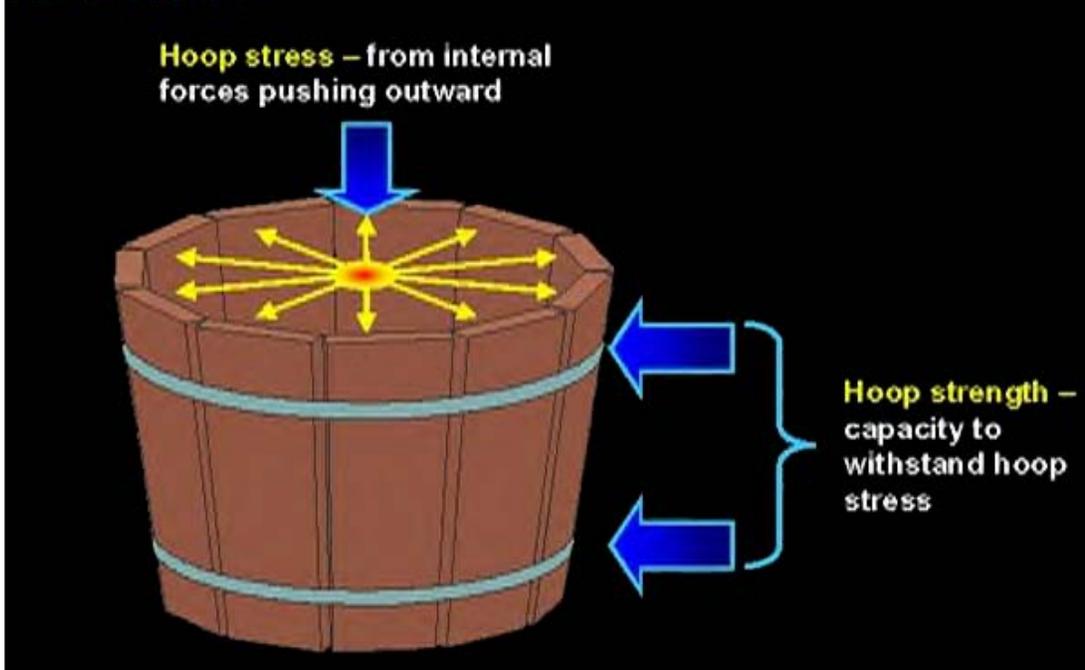
OVERBUILDING EFFECT



GROUND SLOPE EFFECT



HOOP STRESS AND HOOP STRENGTH DEFINED



CAUSAL FACTORS – SUMMARY

Primary factors

Drivers of greater hoop stress

- Wedging
- Vertical log orientation
- Overbuilding
- Ground slope

Drivers of reduced hoop strength

- Weak wiring
- No cables

Collapse