DOCTOR OF ENGINEERING INTERNSHIP

AT DOW CHEMICAL U.S.A.

An Internship Report

by

JAMES DERWOOD SNOWDEN

Submitted to the College of Engineering of
Texas A&M University
in partial fulfillment of the requirement for the degree of

DOCTOR OF ENGINEERING

August 1976

Major Subject: Civil Engineering

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Approved as to style and content by:

(Chairman of Committee)

(Head of Department)

(Member)

(Member)

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August 1976

ABSTRACT

Doctor of Engineering Internship at Dow
Chemical U.S.A. (August 1976)
James Derwood Snowden, B.S., Texas A&M University
M.E., Texas A&M University
Chairman of Advisory Committee: Dr. Alvin H. Meyer

This paper deals with the internship phase of the Doctor of Engineering program during an approximate eleven-month period at Dow Chemical U.S.A. in Freeport, Texas.

The objectives of the internship, the position within the organization, supervisors' names and responsibilities, and a summary of significant work experience are outlined within this paper. A specific job assignment, the construction of a railroad roadbed, is delineated to allow further insight into the work performed during the internship at Dow Chemical U.S.A.

ACKNOWLEDGEMENTS

Utmost appreciation is expressed to the author's committee members for their valuable assistance throughout the graduate program.

To Dr. Alvin H. Meyer, chairman of the author's committee, for his excellent assistance and unlimited patience.

To Dr. William B. Ledbetter for introducing the author to the Doctor of Engineering program and lending a guiding hand during the program's initial phases.

To Dr. Donald McDonald for his direction in the selection of the author's degree program.

To Dr. Ralph J. Vernon for his advice and guidance of the author's degree program within the Industrial Engineering Department.

To Mr. Al C. Learned for his outstanding contributions during the author's internship.

DEDICATION

to Donna

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INTRODUCTION

Doctor of Engineering Internship

This paper deals with the internship phase of the Doctor of Engineering program during an approximate eleven-month period at Dow Chemical U.S.A. in Freeport, Texas. The internship commenced February 3, 1975 and concluded December 19, 1975.

Dow Chemical U.S.A.

The Dow Chemical Company is one of the largest chemical production companies in the United States. It is separated into five area administrations: Canada, Europe-Africa, Latin America, Pacific, and United States. Dow Chemical U.S.A. is an operating unit of The Dow Chemical Company, responsible for the United States area of operation. Dow Chemical U.S.A. is divided into various operating and administrative groups throughout the United States. This paper deals only with the Engineering and Construction Services section of Dow Chemical U.S.A. at Freeport, Texas.

Engineering and Construction Services

Engineering and Construction Services is the section of Dow Chemical U.S.A. responsible for providing engineering, procurement, and construction administration to the various units of The Dow Chemical Company. The intent is to function as an independent engineering firm with the services provided on the basis of need and in conformance with the business practices existing with the units of The Company.[1]

Engineering and Construction Services is divided into six departments. The department responsible for the building of physical properties of The Company is Construction Administration. The other departments furnish engineering, administrative, design, and purchasing functions.[1] The organizational structure of Engineering and Construction Services is outlined in Figure 1.

Construction Administration

The Construction Administration department is separated into various areas of operation, in order to carry out its function of building the physical properties of The Company. One of the larger areas is in Freeport, Texas, where a major chemical production division of Dow Chemical U.S.A. is located. Since this is a production division and one of the various units to which Engineering and Construction Services provides support, many of the construction contracts of the department are active at Freeport.

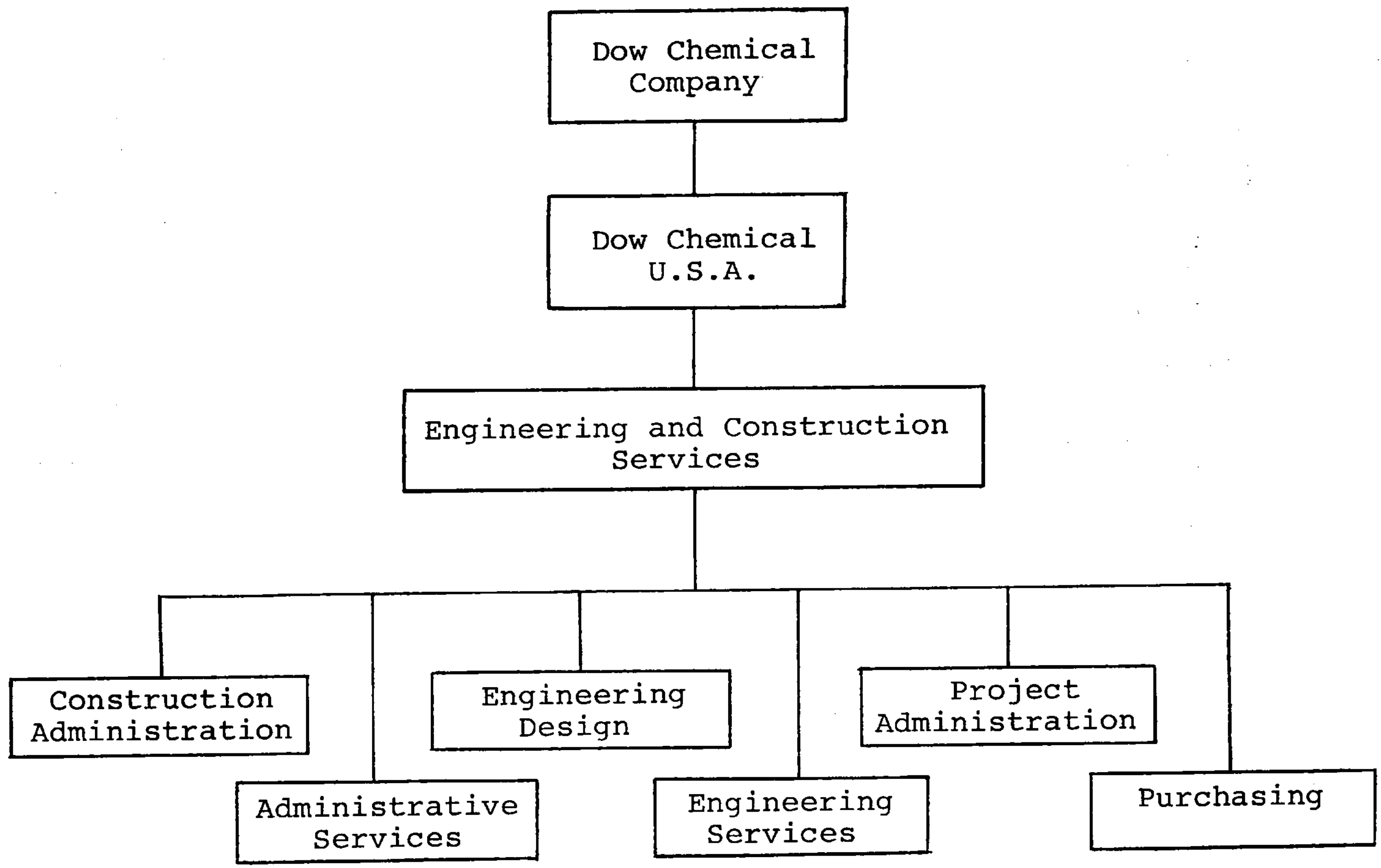

Figure 1. Organizational Chart for Engineering and Construction Services

The Freeport area is separated into two main plants, Plants A and B, for geographic reasons. They are not in themselves chemical production plants, but rather expressions of a geographic location. Each contains within its respective area numerous chemical production and chemical process plants.

The Construction Administration department at Freeport is divided into a contract administration section and an inspection section at each plant location. The contract administration section is essentially responsible for the administrative portion of construction contracts, while the inspection section is responsible for monitoring the quality of the contractor's work. The contract administrators administer the contract, while the inspectors check the contractor's work for adherence to the drawings and specifications. However, these are not absolute definitions, since rigid adherence to the requirements is not always possible. The varied nature of construction work occasionally requires a contract administrator to inspect the work of the contractor. The inspector may also be called upon to administer the contract rather than just inspect the contractor's work. The reasons for this overlapping of responsibility vary, although the major reasons are usually due to manning requirements on a specific job and individual expertise in a particular area.

Major contract work has both the contract administration and inspection sections represented. The contract administrators and inspectors cooperate to insure the contract work is performed properly and in the best interest of Dow Chemical U.S.A. One function complements the other to allow for the most expeditious completion of the work by the contractor.

The concept is carried an additional step in that an owner's representative is also present on the job site of major contract work to directly represent Dow Chemical U.S.A. He performs functions outside the realm of the contract administrator and the inspector in that he officially acts as the liaison between Dow Chemical U.S.A. and the contractor. The owner's representative is not usually a true part of the organizational "chain of command," since he is on the same level as the contract administrators and inspectors.

During the internship at Dow Chemical U.S.A., the author was assigned to the Engineering and Construction Services' Construction Administration department at Plant B, Freeport, Texas as a contract administrator. The first assignment was at Polyethylene Number 4 plant, and the second assignment was at Toluenediisocyanate plant, each located within the Plant B area. Mr. William J. Hughes, the Polyethylene Number 4 Owner's Representative, acted as a supervisor and exercised direct control over the author's work responsibilities during the first assignment. After the assignment to the Toluenediisocyanate plant, Mr. Charlie L. Vollbaum, Plant B's Superintendent of Contract Administration, acted as the author's supervisor. Mr. Al C. Learned, Manager of Construction, Freeport, Texas, was the overall supervisor for the internship. Figure 2 provides additional information as to the organizational structure of Engineering and Construction Services at Plant B.

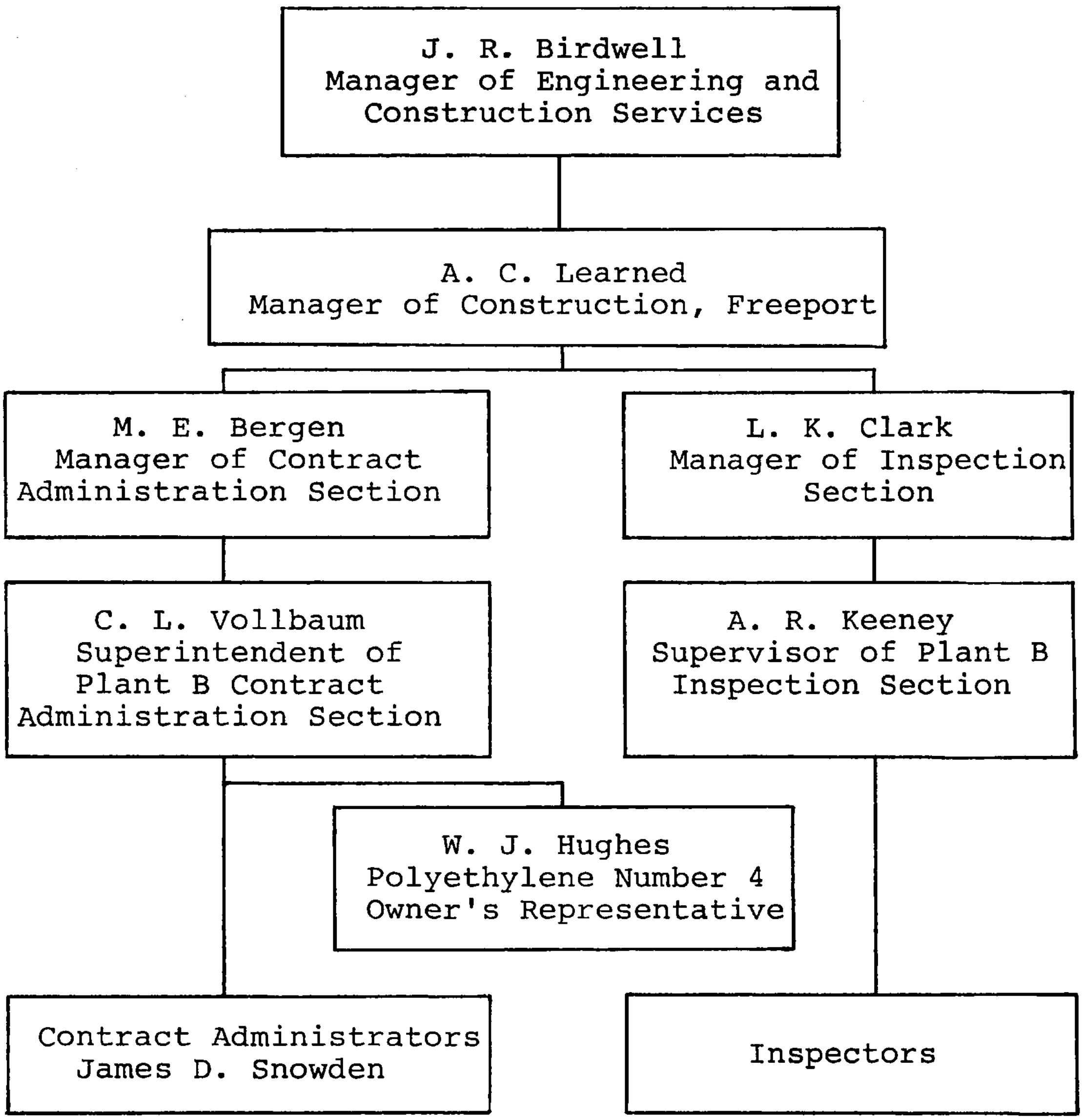

Figure 2. Organizational Chart for
Engineering and Construction Services
Plant B, Freeport, Texas

OBJECTIVES OF INTERNSHIP

The objectives for the internship phase of the Doctor of Engineering degree program were divided into two areas, the objectives of the College of Engineering at Texas A&M University and the objectives of the author.

The objectives of the College of Engineering are: (1) to allow the student to demonstrate his ability in applying his knowledge and technical education to an area of particular interest to the organization, and (2) to allow the intern the opportunity to function in a non-academic environment and to view the organizational approach to current problems.[2]

The objectives of the author were: (1) to gain professional engineering experience, (2) to gain valuable non-academic experience within the field of construction management, and (3) to make a worthwhile contribution to the company in which the internship was served.

INTERNSHIP AT DOW CHEMICAL U.S.A.

The author was assigned the responsibility for numerous functions during the internship at Dow Chemical U.S.A. Each was unique, varying in size and complexity, while offering its individual challenge. However, the major functions were the inspection of the installation of all pipe lines, all pipe supports, all concrete work, all steel construction work; the writing of various field construction orders for alteration and modification work; and the inspection of the construction of the railroad roadbed.

The inspection of the pipe lines required that the author examine all pipe and its associated equipment for adherence to the drawings and specifications. Each line was checked for the proper size of pipe, the correct pipe valves, the proper arrangement of the pipe line, the required instrumentation, and other requisites associated with individual pipe lines.

The inspection of the pipe supports required that the author check each individual pipe line to insure its proper support. The drawings and specifications outlined various pipe supports; however, field changes and operational requirements dictated the installation of additional supports. The author, being cognizant of the necessary requirements, worked with the contractor to assure that correct supports were installed.

The inspection of the concrete and steel work required that the author insure adherence to the drawings and specifications and plant operational requirements. On several occasions the author was required to modify the drawings of the concrete and steel work to assure compliance with the requirements. These additions and modifications were relayed to the contractor.

Any additions, modifications, or alterations of the drawings and specifications required a field construction order, which necessitated a complete survey of all the work to be performed. Field drawings were prepared for inclusion in the construction orders, and the contractor was notified of the change. To minimize errors the author maintained close contact with the contractor while work was being performed on the field construction orders.

The varied nature of the internship at Dow Chemical U.S.A. precludes a detailed description of all work performed. Therefore, one specific job is selected by the author as typical. The various tasks which occurred during construction are fully outlined in the subsequent section. As a further aid, a chronological listing of all significant events which occurred during the entire internship is provided in the appendix.

Construction of the Railroad Roadbed

The construction of the railroad roadbed was selected by the author as representative of the work performed during the internship. Its construction consisted of all work normally associated with contract administration and also fulfilled the objectives of the internship. For these reasons the construction of the railroad roadbed was considered as best typifying the work performed during the internship.

Background

The Polyethylene Number 4 plant is a multimillion dollar facility designed to produce substantial quantities of polyethylene. The plant is divided into two separate but identical production modules, modules 1 and 2. The polyethylene produced by the modules is in the form of small pellets, which are used for a variety of purposes, as in thin film products, plastic products, and numerous other commodities. Since the polyethylene pellets are not utilized locally in any quantity, they are shipped to other plants for ultimate utilization. The most efficient method of transporting the pellets is by large railroad hopper cars specifically designed for this purpose. Therefore, the construction of a railroad spur to the plant was required.

Railroad Spur

The railroad spur was tied in to an existing main railroad track that lies to the north and the east of the Polyethylene Number 4 plant. Because of the arrangement of the plant in relation to the main railroad track, three tie-ins to the existing track were required. A plan view of the railroad spur is shown in Figure 3.

Approximately 2000 linear feet of new track was required for the railroad spur. This permitted the railroad hopper cars to be placed on the spur from one end, loaded with polyethylene pellets in the plant's railroad loading structure, and removed from the spur at the opposite end. Additionally, the spur allowed for storage of railroad hopper cars as required. An east elevation view of the railroad loading structure is shown in Figure 4, and a typical cross-section of the railroad spur is shown in Figure 5.

Contract Phasing

It was decided by the management of Dow Chemical U.S.A. to phase the construction of the railroad spur in two parts. First, the railroad roadbed was to be constructed under one contract, which was the author's responsibility. The second part, the construction of the railroad track and the placing of its ballast, was a separate contract for which another contract administrator was

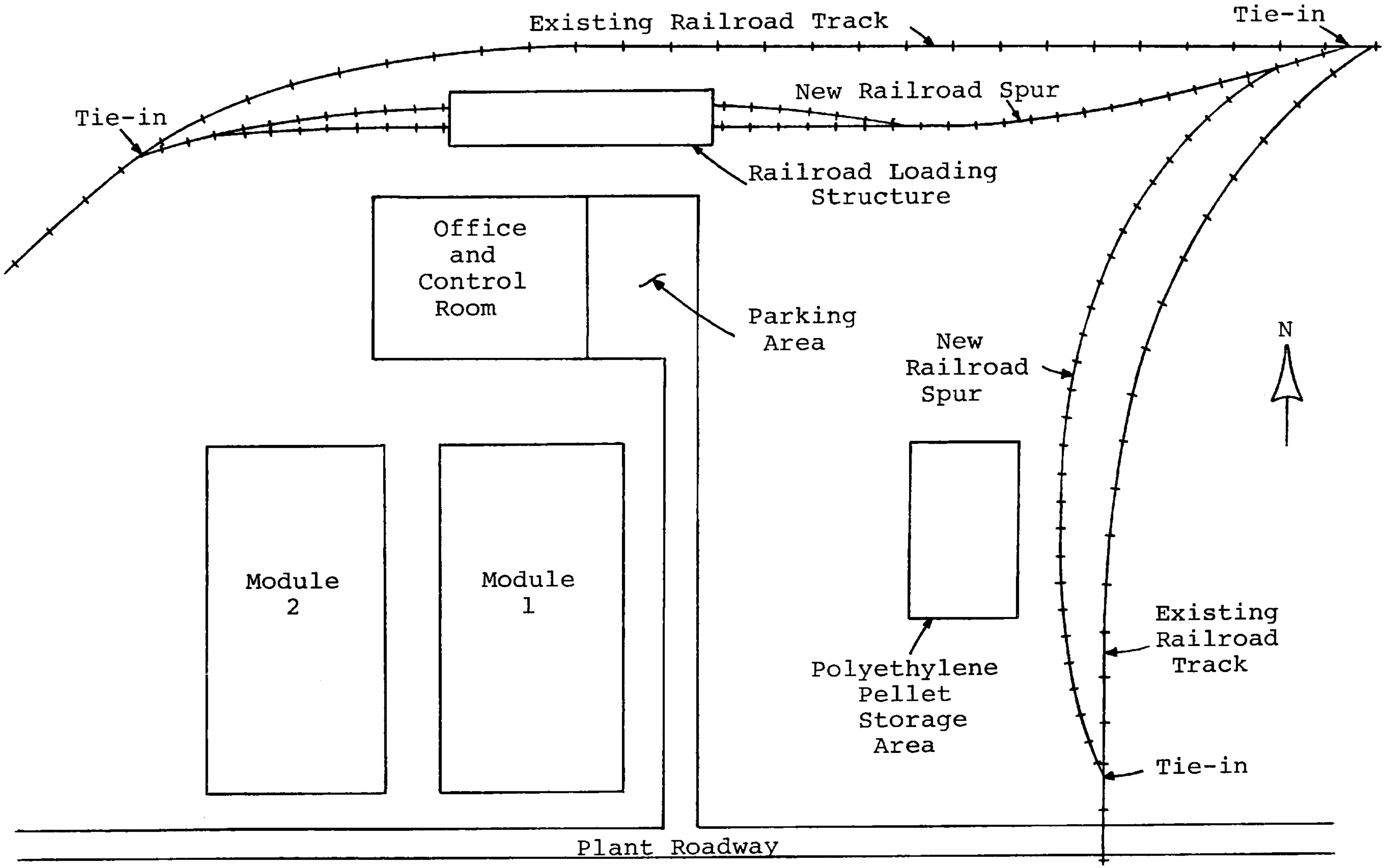

Figure 3. Plan View of Polyethylene Plant and Railroad Spur

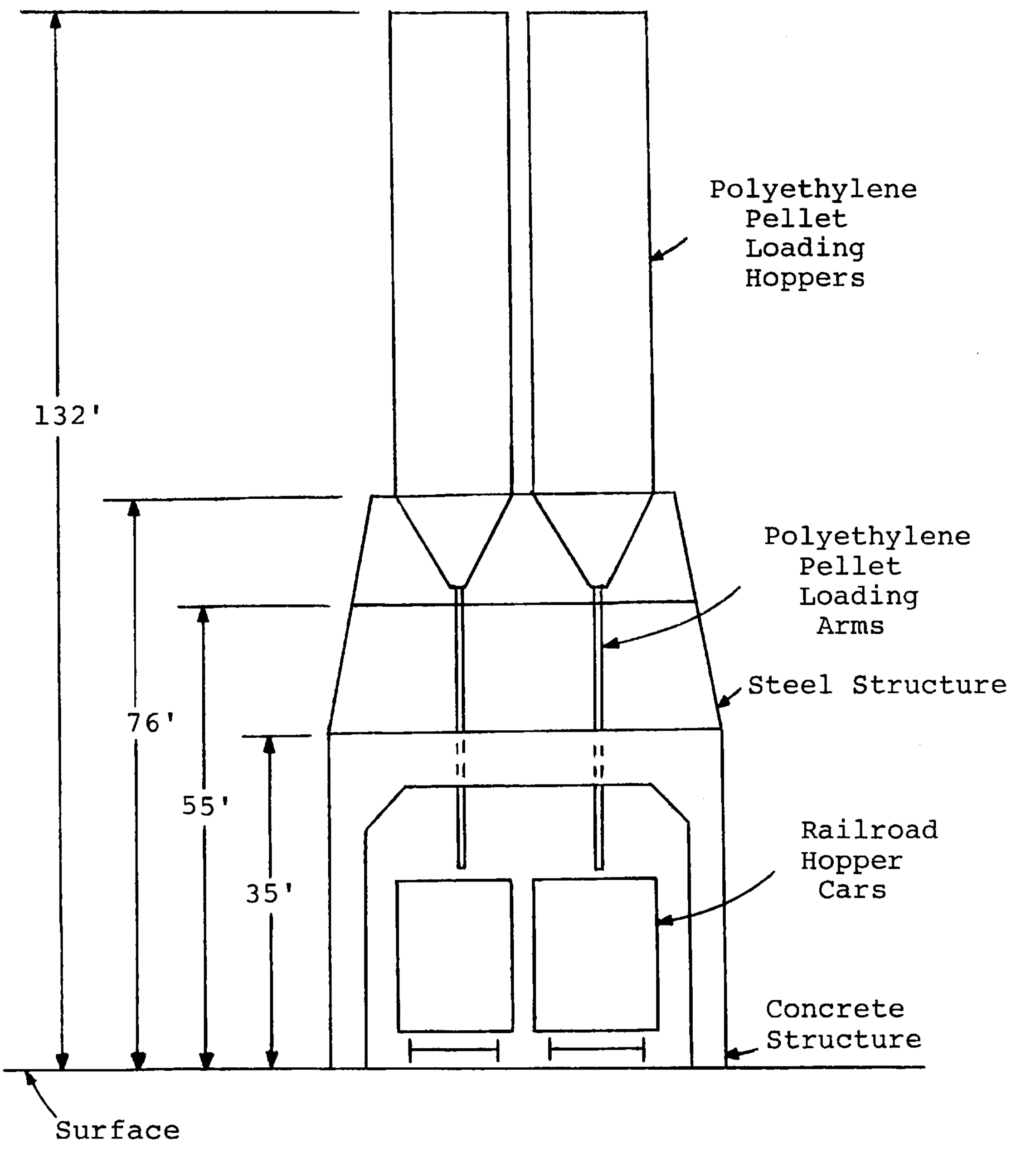

Figure 4. East Elevation View of Railroad Loading Structure

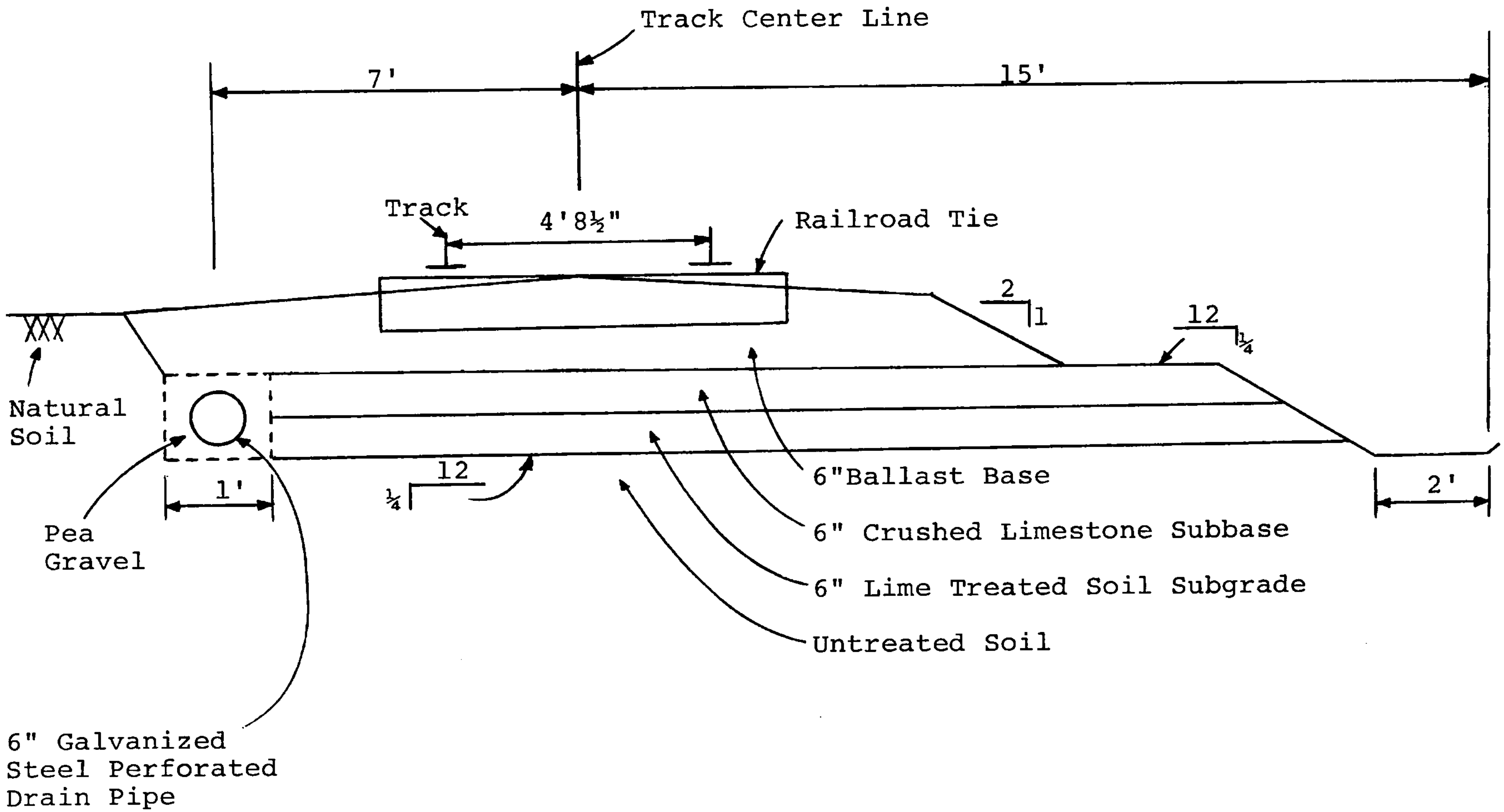

Figure 5. Typical Cross-Section of Railroad Spur

responsible. The second contract completed the construction of the railroad spur for the Polyethylene Number 4 plant.

Contract phasing is a method Dow Chemical U.S.A. frequently utilizes in the construction of its facilities. The phasing of contracts offers two distinct advantages. First, a better facility is obtained because of phasing, since the contracts are divided into areas of specialization. In the case of the railroad spur, the first contract was for the construction of the railroad roadbed. This was an area for a contractor specializing in site work and general roadway construction. The second contract was for the construction of the railroad track and the placing of its ballast. This allowed a contractor who specialized in railroad track construction to bid directly on the contract rather than to act as a subcontractor or a prime contractor for the entire construction operation.

The second reason it is advantageous to phase a contract is because of the increased number of contractors who will bid on the contract. Consequently, the contract is more fully open to competition among bidders, especially in the case of a large contract. Only a limited number of contractors bid on a large contract, while the same contract divided into various parts or phases considerably expands the field of possible bidders. In some instances, the result is lower overall construction costs.

The phasing of the contract has the disadvantage of greater initial cost. This increased cost to Dow Chemical U.S.A. is due to the greater administrative cost of the contract. However, the use of specialized contractors often produces a better facility. Therefore, it requires less maintenance and has greater longevity. Also, the increased competition among the bidders may result in lower construction cost. Although the administrative cost may be greater, during the life of the facility the total cost may be reduced by contract phasing. The author believes that in the case of the railroad spur the advantages of phasing the contract outweight the disadvantage of greater administrative cost.

Construction

Prior to the actual construction of the railroad roadbed, the author familiarized himself with the project. The drawings and specifications were fully reviewed for possible errors and omissions. The author also checked the quantity of lime specified for the subgrade to verify its adequacy. The specifications required 18 pounds of lime for each square yard of soil stabilized to a depth of 6 inches. This rate of approximately 4 percent lime by weight was verified as proper for the silty clay soil within the area.

A pre-work conference was held on February 4, 1975 by Mr. William J. Hughes, Polyethylene Number 4 Owner's Representative. The conference was attended by Mr. Hughes; representatives from Site Construction, Incorporated, the railroad roadbed contractor; and the author. It acquainted the contractor with the various work and safety requirements at Dow Chemical U.S.A. The conference was also held to clarify any points in question, to generally inform the contractor of his responsibilities, and to insure his awareness of the requirements. At the close of the conference, the author was informed by the contractor that all requirements were understood.

The contractor began construction work on the railroad roadbed on February 5, 1975. The contract allowed 35 total working days for completion. If at any point the contractor could not work on the roadbed because of weather conditions, delay in material delivery, or for any other valid reason beyond his control, he was granted an extension on the completion date.

Before the author permitted the contractor to actually begin work, it was necessary to obtain two work permits from Dow Chemical U.S.A. The contractor first acquired an excavation permit, which was required for all grading or excavation work of any type both by equipment or by hand. A safe work permit was also required, since the contractor worked in a hazardous area.

The contractor began work by surveying the area of the proposed railroad spur. Excavation work immediately followed as the survey work was completed. During the time the contractor was actually working on the railroad roadbed, the author endeavored to be present. However, this was not altogether possible, since other responsibilities at the Polyethylene Number 4 plant precluded time being devoted exclusively to the contractor.

During the early phases of the site survey and excavation work, the author was called upon numerous times by the contractor to answer questions and clarify the drawings and specifications. Typical questions the contractor asked were related to the storage of his equipment at the end of the work day, the disposition of excess material from the excavation, and the surveying of the proposed railroad spur.

The excavation work progressed well and was completed on schedule. The only problem that occurred during the excavation was the interference of an existing power pole with the proposed railroad right-of-way. The drawings indicated that the owner, Dow Chemical U.S.A., was responsible for removal of the power pole. However, the contractor progressed to the point that it interfered with his work. After the author apprised the Utility Section at Dow Chemical U.S.A. Plant B's office of the problem, the power pole was expeditiously removed. The contractor completed the excavation work without further delay.

The next operation was the lime stabilization of a 6-inch layer of the existing soil utilizing the mix-in-place method. The natural soil subgrade was first prepared. Bulk hydrated lime was then spread on the prepared subgrade from a bulk lime tank truck. A single rotor stabilizing unit pulverized and mixed the soil and lime together. Water was then added from a water truck, and the entire mix was compacted with a medium-weight pneumatic-tire roller.

Since the contractor had two crews working simultaneously, lime stabilization began before the excavation work was fully completed. The author examined the areas in which the contractor had completed his excavation work for adherence to the drawings and specifications and to insure that the contractor was prepared to begin lime stabilization of the subgrade material. If an area was deemed satisfactory, it was released to the contractor. Unfortunately, owing to inclement weather conditions, delays were encountered, and the contractor was unable to begin his lime stabilization in some areas immediately after excavation. Lime stabilization work began, however, after the author released an area and when the weather permitted.

During the compaction and curing of a lime-stabilized area of the roadbed, the author discovered that approximately a 20- by 75-foot area was not compacted properly. The contractor utilized a medium-weight pneumatic-tire roller to compact the lime-stabilized soil subgrade to the required 95 percent density. However, in this area the roller deeply rutted the soil in lieu of compacting it. The author informed the contractor that the area failed to compact properly; it was to remain in its present condition until the problem was resolved.

Mr. Hughes and Mr. M. C. Koenig, who was Plant B's engineer in charge of railroads, were contacted, and a meeting time was arranged by the author. Mr. Hughes, Mr. Koenig, the contractor, and the author discussed the problem and decided the area was unstable because of a quantity of sandy material, which existed throughout the plant area. The author suggested that the area be stabilized to a depth of 6 inches with 4 percent by weight of type I portland cement. This was approximately 20 pounds of cement per square yard of area stabilized to a depth of 6 inches. The contractor was informed the cement stabilization of the area would be an additional cost item and managed on a cost plus basis. He agreed and immediately proceeded to stabilize the area with cement.

After a four-day curing period, the cement-stabilized area was inspected by the author. It was still judged unsatisfactory as the pneumatic-tire roller continued to rut the soil. The author informed Mr. Hughes of the need for further stabilization work and suggested than an additional 10 pounds of portland cement per square yard be added to the area at a depth of 6 inches. Mr. Hughes concurred with the recommendation. The contractor was informed of this new requirement and agreed to add the supplemental cement.

The author again inspected the area after a four-day curing period. The soil appeared at this point to have gained sufficient strength to be acceptable. An independent materials testing laboratory was called by the author to verify the density of the area. The results of the test indicated the area met the specification requirement of 95 percent density. The author then notified the contractor that the area was satisfactory.

The testing laboratory operated on an individual job basis throughout the construction of the Polyethylene Number 4 plant. The laboratory was available as required, and the author needed only to inform them of the type of test to be performed and the area where samples were to be taken. The results of the tests were sent to the Polyethylene Number 4 Owner's Representative, Mr. Hughes.

Two additional areas of the roadbed failed to meet the requirements for subgrade density as outlined in the specifications. This failure was not due, however, to unsatisfactory material within the area, rather to improper mixing of the lime into the soil and improper compaction after the mixing. The contractor was notified by the author of the areas which failed to meet the specifications and that additional mixing and compaction were required. At the author's direction, the testing laboratory continued to take samples of the areas as they were completed. The contractor was notified of the test results as they became available.

As the satisfactory areas were released by the author, the contractor began work on the crushed limestone subbase, his final stage of construction. It was during this final stage that the contractor installed the galvanized steel perforated drain pipe. The pipe was required for an area of the railroad spur that did not drain directly into an open ditch.

Unfortunately, the contractor placed only a small portion of the crushed limestone subbase before exhausting his supply of material. All normal suppliers of crushed limestone were contacted without success. The contractor then apprised the author that a delay in the subbase construction would occur because of the shortage of the limestone. The author informed the contractor that an extension would be added to the contract.

After approximately two weeks delay, the contractor received shipments of crushed limestone. He immediately began to spread and compact the limestone with a medium-weight pneumatic-tire roller to the required density of 95 percent. Again, as an area was completed by the contractor, the author had the testing laboratory take samples for density tests. All the samples which were taken on the crushed limestone subbase met the requirement of 95 percent density.

The final operation performed by the contractor was grading the crushed limestone subbase to its finished elevation. As areas of the subbase were determined satisfactory and released by the author to the contractor, the final grading operation was begun. The contractor accomplished the finished grading operation with a standard grader and 10-foot blade.

The drawings and specifications required that the finished surface of the crushed limestone subbase be sloped at 1/4 inch in 12 inches to allow lateral drainage. Because of this important consideration, the author closely monitored the contractor's finished grading operation. This enabled the author to locate several areas of the subbase not meeting the specification. After being informed of the discrepancies, the contractor promptly corrected the areas.

After the contractor concluded his work, a final inspection was conducted on the railroad roadbed by Mr. Hughes and the author. This inspection was held on April 15, 1975.

The roadbed was then ready for the second phase of the railroad spur contract, the laying of the railroad track and the placing of the ballast.

Summary

The construction of the railroad roadbed was delayed a total of three weeks owing to circumstances beyond the contractor's control. The contractor was delayed approximately one week because of inclement weather conditions. The second major delay, approximately two weeks in duration, was the result of a shortage of crushed limestone. With the delays added to the original construction time of 35 days, the contractor completed the construction of the railroad roadbed in the required amount of time.

The contractor was very capable and knowledgeable within his field of construction and willing to find equitable solutions to the problems encountered. The work was performed in a professional manner in accordance with the drawings and specifications.

The construction of the railroad roadbed was an ideal project on which to have worked during the internship. Valuable experience was gained in almost every basic aspect of construction. This included experience gained both while working directly with the contractor and experience gained while coordinating and administering the construction work of the contractor. The author believes the work on the construction of the railroad roadbed was extremely beneficial to his overall experience at Dow Chemical U.S.A.

CONCLUSION

The internship at Dow Chemical U.S.A. was a rewarding and satisfying experience. The construction field was viewed from many standpoints, and each afforded a valuable insight into the construction operation of a major company.

The author believes without question the major objectives of the College of Engineering at Texas A&M University were fulfilled during the internship. The first objective of the College of Engineering was to allow the student to demonstrate his ability in applying his knowledge and technical education to an area of particular interest to the organization. This objective was fulfilled throughout the entire internship program. Both the assignment at the Polyethylene Number 4 plant and the Toluenediisocyanate plant allowed the author to apply his knowledge and technical education to an area of interest to Dow Chemical U.S.A.

The second objective of the College of Engineering was to allow the intern the opportunity to function in a non-academic environment and to view the organizational approach to current problems. This objective was also fully accomplished during the internship. The author was able to function in a non-academic environment where he not only viewed the organizational approach to current problems but also assisted in resolving the problems.

The author's personal objectives were also considered to be successfully met during the internship. The first objective was to gain professional engineering experience. The author was at all times able to function as a professional engineer, performing professional engineering work. The internship was an exceedingly worthwhile experience.

The second personal objective was to gain valuable non-academic experience within the field of construction management. The author worked completely within this field throughout the internship. Valuable experience and insight were acquired in the accomplishing of this objective.

The final objective of the author was to make a worthwhile contribution to the company in which the internship was served. During the internship the author strove to fully contribute in a manner acceptable to both himself and to Dow Chemical U.S.A. The results were believed to be mutually advantageous.

The internship successfully accomplished all established objectives. However, another important result was also achieved. This was to provide the author with responsibility and challenge. As the internship progressed, the author was given successively more responsibility. At one point, the author was responsible for five separate and distinct functions within the overall construction operation. This included responsibility for inspecting the installation of all pipe lines, all pipe supports, all concrete work, all steel construction work, and responsibility for estimating the progress of various work throughout the plant area.

The author also wrote 52 field construction orders for a total cost of over $230,000. The field construction orders were for alteration and modification work throughout the Polyethylene Number 4 plant and the Toluenediisocyanate plant. Therefore, from all standpoints, the internship was extremely successful.

Everyone at Dow Chemical U.S.A. was extremely accommodating in their efforts to assist the author during the internship. They were very eager to insure that the internship was conducted in the proper manner. Appreciation is extended to all who made the internship at Dow Chemical U.S.A. a possibility as well as a successful reality.

REFERENCES

1. "Employee Handbook," Engineering and Construction Services, Dow Chemical U.S.A.

2. "Guidelines for Doctor of Engineering Internship Report," College of Engineering, Texas A&M University, College Station, Texas.

APPENDIX

CHRONOLOGICAL LISTING OF SIGNIFICANT EVENTS DURING THE INTERNSHIP

CHRONOLOGICAL LISTING OF SIGNIFICANT EVENTS DURING THE INTERNSHIP

February 3, 1975 to December 19, 1975

DATE	EVENTS
February 3	Assigned as a contract administrator to Engineering and Construction Services, Polyethylene Number 4, Plant B, Freeport, Texas
February 4	Assigned responsibility for railroad roadbed inspection
February 5	Began modification of plans for Polyethylene Number 4 plant
February 12	Assigned responsibility for pipe lines inspection
February 18	Finished modification of plans
February 19	Assigned responsibility for all concrete inspection
February 24	Conferred with Plant B's engineer in charge of the railroads about stabilization of roadbed
March 11	Discussed progress of Polyethylene plant air compressors with project engineer
March 12	Wrote a construction order for pipe supports
March 17	Wrote a construction order for altering a lubrication oil pipe line
March 18	Dr. Meyer and Dr. Rodenberger visited the Polyethylene plant
March 19	Wrote a construction order for altering an air pipe line
March 21	Wrote a construction order for pipe supports. Assigned responsibility for all steel inspection

DATE	EVENTS
March 25	Wrote a construction order for altering various pipe lines
March 27	Wrote a construction order for pipe supports
April 1	Wrote a construction order for altering steam and condensate pipe lines
April 4	Wrote a construction order for altering a 12" concrete drain pipe
April 9	Wrote a construction order for pipe supports
April 15	Finished inspection of railroad roadbed
April 17	Wrote a construction order for altering electric motor housing
April 18	Wrote a construction order for altering steel walkway
April 29	Attended a pre-work conference for railroad track construction
April 30	Wrote construction orders for installing polyethylene pellet skimmers and altering heat exchangers
May 2	Wrote a construction order for installing a steel equipment inspection platform
May 5	Wrote construction orders providing for drainage to numerous areas
May 8	Selected material for contractor to use in roadway
May 12	Reviewed previous work of contractor to determine responsibility for errors
May 13	Wrote a construction order for pipe supports

DATE	EVENTS
May 15	Wrote a construction order for installing a concrete slab
May 16	Wrote a construction order for installing steel equipment access platform
May 20	Investigated two job-related accidents
May 21	Estimated cost of six construction orders
May 23	Estimated remaining steel erection work of contractor
June 3	Took the project civil engineer on an investigation of equipment damaged by high winds
June 4	Wrote a construction order for installing equipment sheds
June 6	Wrote a construction order for installing steel access platforms to 19 filter units
June 12	Wrote a construction order for installing high pressure pipe supports
June 17	Reviewed required equipment modification work of the contractor
June 27	Wrote a construction order for pipe supports
July 3	Wrote a construction order for bracing high pressure vent piping
July 7	Wrote a construction order for pipe supports
July 8	Checked the structural design of steel pipe support columns
July 11	Wrote a construction order for installing a steel access platform
July 14	Began the work on the supporting of the pipe to the high pressure com-

DATE	EVENTS
July 14 (cont'd)	pressor in module 2
July 17	Wrote a construction order for installing steel platforms
July 25	Wrote a construction order for installing a drain pipe
July 28	Wrote a construction order for installing two steel monorails
July 31	Toured plant with project engineer to determine reinforcing requirements of pipe support columns
August 1	Wrote a construction order for installing two steel monorails
August 7	Wrote a construction order for installing steel platform for valve access
August 8	Wrote a construction order for pipe supports
August 12	Wrote a construction order reinforcing pipe support columns
August 20	Performed level survey verifying accuracy of equipment placing by contractor
August 22	Wrote a construction order for bracing high pressure pipe lines and steel access platforms to equipment
August 29	Assisted project engineer in relocating flare stack
September 2	Module 2 began production of polyethylene
September 3	Began work on the supporting of the pipe to high pressure compressor in module 1
September 15	Took an equipment representative on a check of his equipment installation

DATE	EVENTS
September 19	Wrote a construction order altering a steel platform
September 20	Performed an instrument takeoff verifying work of the contractor
September 26	Visited steel fabricators verifying the proper design of high pressure compressor pipe supports
September 30	Wrote a construction order for pipe supports
October 7	Began work on a part-time basis on the pipe supports for the Toluenediisocyanate (TDI) plant
October 13	Assisted in determination of cause of equipment failure in Polyethylene Number 4 plant.
October 17	All work but the installation of pipe supports to the high pressure compressor is essentially completed by the contractor in Polyethylene Number 4 plant. The author continued work on the high pressure pipe supports
October 21	Wrote a construction order for installing high pressure pipe supports
October 29	Author's work was completed at Polyethylene Number 4 plant
October 30	Assigned full-time to TDI plant to work on pipe supports throughout the plant
November 3	Discussed requirements for pipe supports with contractor
November 14	Attended meeting of Industrial Representatives to Doctor of Engineering program
November 18	Wrote a letter to TDI representatives apprising them of an existing procedure in pipe supporting believed to be unsafe

DATE	EVENTS
November 21	Completed work on the pipe supports for the TDI plant
November 24	Began checking the installation of the pipe lines for adherence to drawings and specifications
December 1	Discussed completed work on the pipe supports with the contractor
December 3	Reviewed a proposed outline for a Critical Path Methods course to be taught to contractors and Dow personnel
December 4	Toured the TDI plant with the project engineer to discuss the pipe supports
December 11	Reviewed a steel support design for structural adequacy
December 19	Author's final day of internship

VITA

I, James Derwood Snowden, was born March 8, 1945 in Wichita Falls, Texas to Mr. and Mrs. John Derwood Snowden.

I attended public schools in Wichita Falls, graduating from Wichita Falls Senior High School in May, 1963.

I received my Bachelor of Science degree in Civil Engineering on January 20, 1968 from Texas A&M University. I was employed by LTV, Incorporated in Dallas, Texas, prior to entering the United States Air Force on April 16, 1968. I served as a Civil Engineering Officer during the latter phases of my tour and acquired valuable engineering experience in design and construction of numerous projects. I was released from active duty on July 1, 1973 with the rank of Captain.

I was accepted into the graduate program at Texas A&M University, leading to a Master of Engineering degree in Civil Engineering with options in the materials science and construction management area. I received my Master of Engineering degree August 16, 1974.

I subsequently was accepted into the Doctor of Engineering degree program and served my internship at Dow Chemical U.S.A. in Freeport, Texas.

I am a registered Professional Engineer in the State of Texas. My current residence is 1711-B Lawyer, College Station, Texas.

The typist for this internship report was Mrs. Janice Duren.