Heavy Equipment Technology,
Heavy Equipment Service Engineering Technology

APRC 1998-1999

Section 1 of 8

HEAVY EQUIP. 98-99

ACADEMIC PROGRAM REVIEW

OF

A.A.S. HEAVY EQUIPMENT TECHNOLOGY

B.S. HEAVY EQUIPMENT SERVICE ENGINEERING TECHNOLOGY

AT

FERRIS STATE UNIVERSITY

NOVEMBER 3, 1998

APPENDICES

Recommendations for Heavy Equipment Technology by Priority

1. The bottom line is that the program needs additional funding. This year alone, industry has contributed almost $100,000 worth of equipment and support. Even with this industry support, the program requires increased financial support! An increase of $8,000 per year is needed in the S & E account. This amount would only catch the program up with what have been spent per year average over the last four years. As the program grows, additional revenue comes into the University as well as additional costs. Budget increases have not kept pace with costs even though more students are in the programs.
   Another $24,000 to $25,000 per year has been given to the program as Vocational Education funds from the Perkins Act. This extra amount of money available has also been spent on equipment specifically for the A.A.S. program. It is available because of the A.A.S. program. In 1998, most of those funds are being spent on computer hardware and software. A recent inventory of all the computers and computer generated equipment determined over 100 computers in the Heavy Equipment Center. There has been little additional money supplied for computer needs over recent years. An additional $8,000 is requested and will be spent on increased computer needs. As fast as electronics and computers evolve in recent years, needs are continual and an additional $8,000 per year would just barely keep the program abreast of yearly computer upgrade needs.

2. It is recommended that the programs, which require advanced computer and electronic training, be updated with new equipment.

3. Heavy Equipment Program Coordinators current activities in addition to posted duties. You will find attached a copy of the Program Coordinators job description.
   - Meet with prospective parents and students to conduct tours.
   - Contact prospective as given by admissions.
   - Schedule and conduct two advisory committee meetings per year.
   - Travel to secondary/post-secondary schools for recruiting/and/or articulation.
   - Give presentations to associations/industry/educators.
   - Conducts research on new market approaches.
   - Coordinate Transportation Institute activities along with the Transportation Institute Director.
   - Coordinate budgets for A.A.S. and B.S. program.
   - Meet regularly with college, department and program personnel.
   - Coordinate NATEF certification/self-evaluation activities for 1999 Spring evaluation.
   - Daily facility management activities.
   - Organize and conducts yearly secondary teacher update program.
   - Organize and conduct yearly Technical Symposium presentations by industry.
   - Serve as chair of Tenure (COT) Committee.
   - Conduct regular communication with secondary/post-secondary programs by newsletters, telephone, e-mail.

Recommendation is to give Program Coordinator full time administrative duties at 100% teaching release time.

4. Additional Full-time faculty for B.S. degree.
5. 60 x 120 Storage Building
6. Recommend increased marketing for B.S. program.
7. Co-op program possibilities investigated.
8. Electrical power generation certificate study.
9. Develop 401 course.
10. Hold two Advisory Board meetings per year.
11. Increased communication with Advisory Board.
12. Develop Advanced Testing Class for the Manufacturing option.
13. Purchase a Data Acquisition System.
14. Computer hook-ups in classroom/labs.
15. Up-Date computer lab.
16. Equipment (Ag, Const., Forestry, Truck) possibly investigate lease.
17. Move electronically controlled hydraulics to Associates degree program.
18. Move Auto/Electronically shifted trans to Assoc. (develop new course)
19. Research "Other Electrical Systems" ie. (GPS, Fiber Optics, Radar etc.)

Additional Priorities

Associates

- Decription of HEQT 201 changed.
- Re-Adjust Prerequisites
- Re-evaluate Psyc 150
- Construction electronic brake research
- Faculty proficient in trouble shooting

Bachelors Maintenance and Repair

- Re-evaluate Plsc 311
- Start charging systems research
- Driveline research
- Electronic Brake in construction research

Bachelors/Manufacturing

- Eliminate MFGE 313
- Re-evaluate Econ 221, Mgmt 301 & Plsc 311

Position Description: Program Coordinator, College of Technology (COT)
May 8, 1996

I. Preamble

The Program Coordinator is a senior faculty member (at least 3 years of teaching experience, masters degree preferred) within a program grouping who, where appropriate, also meets the programmatic accreditation requirements for the position. The program coordinator is accountable to a designated Assistant Dean/Department Head for assignment and conduct of duties.

The program coordinator represents the program's students, faculty and curriculum to the Assistant Dean/Department Head and represents the same to the program's students, faculty and its stakeholders. In fulfilling these duties the program coordinator is expected to follow the established policies and procedures of Ferris State University and the College of Technology as well as the provisions of the relevant collective bargaining agreements.

The program coordinator's main duty is to direct activities pertaining to academic effectiveness, efficiency, and where appropriate, accreditation of the respective programs under their charge. The program coordinator also represents the program(s) as necessary within the institution, and at local, state and national meetings.

II. Leadership

The program coordinator is responsible for providing leadership which allows the department to attain appropriate educational objectives while promoting the common interests of the program(s), department, college and university. The program coordinator is advised by the faculty and the advisory committees of the group's program(s).

In fulfilling the leadership aspects of the office, the program coordinator promotes and maintains high academic standards within the program(s) including the advancement of scholarship and curriculum development activities. The program coordinator encourages and promotes new ideas, and fosters and maintains an intellectual and creative climate within the program.

III. Specific Responsibilities (may be modified to meet the needs of the department or program). Under the direction of the Assistant Dean/Department Head the program coordinator's duties include:

1. Teach up to half time in their program (i.e., area of expertise)
2. Develop faculty schedules for the program(s)
3. Schedule rooms and resolve block schedule conflicts
4. With faculty input, order supplies and equipment needed for the program(s)
5. Coordinate program tours and school visits
6. Maintain an up-to-date list of equipment and other needs in priority order

COLLEGE OF TECHNOLOGY
Johnson 200, 1009 Campus Dr., Big Rapids, MI 49307-2890
Phone 616 592-2890

Page 2, Program Coordinator's Duties Continued:

7. Organize Summer orientation activities unique to program(s)
8. Submit repair and other work orders as needed
9. Maintain industrial contacts for program(s)
10. Seek equipment and cash donation for program(s)
11. Facilitate curriculum changes working through all appropriate committees
12. Coordinate unit action plans for the program and report on progress
13. Review student applications and sign requests for curriculum transfers for program(s)
14. Schedule and chair regular program faculty meetings
15. Assist in the hiring process related to program personnel
16. Maintain up-to-date printed program materials
17. Coordinate minor capital improvements
18. Schedule and chair annual advisory board meetings
19. Prepare routine and non-routine reports required of the program
20. Assist in the development of the annual budget request and projected supplemental faculty needs
21. Insure that the program continues to meet or exceed all related standards (i.e., general education, accreditation, NCA, etc.)
22. Coordinate the proper supervision of internships and assist in finding sites
23. Advise prospective students
24. Advise off-campus students where such programming exists
25. Serve as a student and faculty advocate within the department and college
26. Serve on departmental, college and university committees

IV. Evaluation

The program coordinator's non-instructional duties are evaluated annually by the Assistant Dean/Department Head using the evaluation system prescribed for unclassified administrative staff and officers of the university. In this evaluation system the emphasis is upon the program coordinators setting annual objectives. The year's objectives are evaluated in terms of accomplishment.

Darcy per your request!

ADMINISTRATIVE PROGRAM REVIEW

Program/Department: HEAVY EQUIPMENT TECHNOLOGY/TRANSPORTATION & ELECTRONICS DEPARTMENT

Date Submitted: ______________________ **Dean:** ______________________

Please provide the following information:

Enrollment/Personnel

	Fall 1992	Fall 1993	Fall 1994	Fall 1995	Fall 1996	F9
Tenure Track FTE	8	7	7	6	6	6
Overload/Supplemental FTEF					2	2
Adjunct/Clinical FTEF (unpaid)						
Enrollment on-campus total*	83	59	72	107	89	11
Freshman	35	28	45	60	44	5
Sophomore	27	26	25	37	35	4
Junior	15	4	4	8	10	1
Senior	6	1		2		
Masters						
Doctorial						
Enrollment off-campus*						

*Use official count (7-day count for semesters, 5-day count for quarters).

Financial

Expenditures*	FY92	FY93	FY94	FY95	FY96	FY
Supply & Expense	13,842	16,908	9,599	26,394	21,982	22
Equipment			15,340	16,584	14,679	16
Gifts & Grants						

*Use end of fiscal year expenditures.

Other

	AY 91-92	AY 92-93	AY 93-94	AY94-95	AY 95-96	96
Number of Graduates * - Total	31	43	21	8	19	3
- On campus	31	43	21	8	19	3
- Off campus						
Placement of Graduates	90%	90%	90%	90%	90%	9
Average Salary	20,230	22,394	21,506	22,800	23,700	2
Productivity - Academic Year Average			291	320	319	2
- Summer						
Summer Enrollment	13	-	5	6	4	5

* Use total for academic year (F,W, S)

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Doug FYI
per conversation in
during 'questions'
at APRC meeting

Kim Miller
11/05/98 02:50 PM

To: John D Shaltry/FSU@Ferris
cc:
Subject: ANDY FOX/KALAMAZOO CENTRAL HIGH SCHOOL

HELLO. I AM THE SOUTHWESTERN MICHIGAN ADMISSIONS FIELD REP. I VISIT HIGH SCHOOLS IN SOUTHWEST MICHIGAN AND TALKED WITH ANDY YESTERDAY. HE HAD A LETTER FROM YOU ALONG WITH A CHECKLIST OF CLASSES AND TOOLS. ANDY IS REALLY THINKING ABOUT NORTHWESTERN IN LIMA, OHIO, BECAUSE HE THINKS THAT THEY WILL ALLOW HIM TO GET "PAID" WHILE HE IS WORKING AND THAT AT FERRIS THERE IS NOT AS MUCH "ON THE JOB" TRAINING AND NO PAY AND HE DOESN'T UNDERSTAND HOW TO PAY FOR ALL OF THIS. HE ALSO IS AFRAID OF TAKING "CULTURAL ENRICHMENT AND ENGLISH CLASSES." I STRONGLY ENCOURAGED ANDY TO CALL YOU TO SET UP A VISIT AND I TRIED TO SHOW HIM HOW TO PAY FOR COLLEGE. I AM THINKING THAT NORTHWESTERN DID A VERY HARD SELL ON ANDY AND HIS PARENTS; STRESSING THE "PAY" ISSUE AND THE FACT THAT HE WOULD NOT HAVE TO "TAKE ALL THAT OTHER JUNK" (I HAVE RUN ACROSS NORTHWESTERN REPS ON THE COLLEGE FAIR CIRCUIT AND THEY ARE RUTHLESS; THEY REALLY CUT US DOWN!) ANDY HAS A 3.5 GPA AND HAS NOT YET TAKEN THE ACT. I AM HOPING HE CALLS YOU AND WE CAN GE
T THIS YOUNG MAN ON CAMPUS. I WAS ALSO WONDERING IF I SHOULD CONTACT THE CATERPILLER FOLKS ABOUT SPONSORING HIM? ANY SUGGESTIONS? ANDY'S ADDRESS IS:

ANDY FOX
57 N. 8TH ST.
KALAMAZOO MI 49009 PH: 616/375-6017

I ALSO WANTED TO THANK YOU FOR SENDING HIM A LETTER AND OTHER INFORMATION. IT IS VERY ENCOURAGING FOR ME TO KNOW THAT OUR FACULTY WILL TAKE THE TIME AND HELP ME IN THIS RECRUITMENT PROCESS. THANK YOU AGAIN.

THE WORK AND INDUSTRY PROFILES OF HEAVY EQUIPMENT GRADUATES AND THE RELATIONSHIP OF ADDITIONAL DEGREES UPON THOSE PROFILES

BY

KENNY R. ACTON

A STUDY

SUBMITTED TO ADMINISTRATORS, FACULTY, STAFF

AND THE ADVISORY COMMITTEE MEMBERS OF

THE HEAVY EQUIPMENT TECHNOLOGY PROGRAM AT

FERRIS STATE UNIVERSITY

OCTOBER 1989

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SECTION 1

INTRODUCTION TO THE STUDY

* The Problem *

The Heavy Equipment Industry is very complex because of the diversity in its structure. The industry is composed of a number of industries incorporated within an industry. The Heavy Equipment Industry includes, but is certainly not limited to, the construction equipment industry, the trucking industry and the agricultural equipment industry. Unlike other industries where the products are well defined in their use, physical systems, maintenance procedures and the knowledge base required to repair them are quite similar; many of the segments of the Heavy Equipment Industry have very little in common beyond belonging to the same industry. For example; consider the use, physical systems, maintenance procedures, and knowledge base required to repair a wood chipper, concrete pump, over-the-road truck, crane, combine, compactor, crawler tractor or road paver. These machines are just a part of the long list of products that fit into the Heavy Equipment Industry classification. Even with such diversity, the Heavy Equipment Industry does mutually share with all other industries the phenomenon of rapidly changing technology.

If one were to choose a single word that best describes all industry as it exists today, it would have to be the word change. Most of this change has been created by the introduction of sophisticated electronic components to control systems that were traditionally mechanically controlled. Once electronically controlled, the addition of a computer to monitor and control several of these electronic mechanical systems yields the optimum for operational efficiency. The degree to which the computer is being used for systems control varies in all industries. Such is also the case within the industries that compose the Heavy Equipment Industry. Therefore, the extent of computer controls and electronic component sophistication greatly impacts the maintenance, method of repair, and the knowledge base required to repair the products in this industry.

As educators preparing graduates for a sucessful career in the Heavy Equipment Industry, we must address these factors of diversification and changing technology with corresponding revisions in curriculum. However, to change curriculum without first establishing a firm foundation from which to build would not only prove to be foolish; but a complete disaster! This foundation must accurately depict the profiles of both our graduates and their employers, which is in essence an instantaneous "snap-shot" of the dynamically changing Heavy Equipment Industry. With such a portrait as a foundation, predictions can then be made as to the significance of any changes and their effects, present and future, on the Heavy Equipment Program and the industry which it serves.

* Purpose of the Study *

This study was designed to collect data which will establish an informational base from which to work. It will also examine various solutions to the complex, intertwined, questions of diversity and change that presently confronts the curriculum of the Heavy Equipment Industry. The results will identify the strong and weak areas of the curriculum and point the direction for further analysis for curriculum improvement.

* Statement of the Problem *

The Heavy Equipment Industry is both diversified and rapidly changing. As educators we need to compare graduate profiles, industry profiles and technology changes to establish a firm base from which to analyze curriculum with projected future needs.

* Research Questions *

1. What is the work profile of the graduates of the Heavy Equipment Program?

2. What is the industry profile of the industries in which the graduates of the Heavy Equipment Program presently work?

3. What is the relation of additional degrees to the work profile of the graduates of the Heavy Equipment Program?

4. What is the relation of additional degrees to the industry profile of the Heavy Equipment Graduates?

5. What recommendations and comments did the graduates of the Heavy Equipment Program offer?

* Definition of terms *

"Additional Degrees": Additional associates, bachelors, master degrees or any combination thereof which the Heavy Equipment Graduate has earned.

"AHM (AHT)": This refers to the bachelors degree of Automotive Heavy Equipment Management offered by Ferris State University. The name was changed a few years ago from Automotive Heavy Equipment Technology (AHT) to management.

"Engineer": The engineer category contains many different types of engineering disciplines; such as, service engineer, logistics engineer, stationary engineer, plant engineer, manufacturing engineer and engineer.

"Fleet Operation": A large company which maintains its own equipment.

<u>"Heavy Equipment Industry"</u>: The industry that designs, manufactures, sells and services the equipment used in Agriculture, Construction, Mining, Forestry, and Over-the-road Trucking.

<u>"Independent Repair Shop"</u>: A company which repairs equipment for others but is not affiliated with any major manufacturer or particular product line.

<u>"Industry Fit"</u>: How well an industry matches the task inventory in this survey. It is a numerical value which ranges from 0 to 3 with the area from 1.0 to 2.0 considered as average.

<u>"Industry or Factory Training"</u>: A formal class or course conducted on specific subject matter that is taught in the traditional classroom type of setting. These courses are usually taught at factories or company training centers. This training should not be confused with everyday "on-the-job" type training to which a new employee or trainee may be exposed.

"Industry Profile": The identification of key factors which define the industries in the Heavy Equipment Industry for which the graduates work.

"Internship": A program whereby a student must work for an employer for a specific period of time, receiving educational credits for the experience, which applies toward the requirements for the completion of their degree.

"Rental Leasing": This refers to those businesses who rent and lease equipment.

"Specialty Shop": A repair facility which specializes in a particular special area. For example, electrical component rebuilders, or diesel injection pump rebuilders.

"Trainee": A work classification that is set up by an employer. Its primary purpose is to give a new employee the necessary time to learn the requirements of the job for which they were employed.

"Trucking Business": This refers to the business of an independent contract hauler, freight hauler or common carrier.

"Trucking Industry": This refers to that industry which sells, services or repairs over the road trucks.

"User Shop": A small company which has its own repair facility for repairing its own equipment.

"Work Profile": The identification of key factors which define the Heavy Equipment Graduate.

* Delimitations of the Study *

This study was not designed specifically for implementing curriculum change, and should not be used as such. The information should be used to identify those areas of curriculum that should be considered for further study.

* Limitations of the Study *

This study was designed to provide the administration, faculty and advisory committee of the Heavy Equipment Program at Ferris State University, as well as the people of the State of Michigan, with the basic profiles of the graduates and the industries for which they work. The intent was to identify any major areas of concern and address them only after further studies are conducted. The following limitations must be taken into consideration when reviewing this study:

"Literature Review": It was the intent of this survey to study the graduates from 1978 through 1988, of the Heavy Equipment Service Program at Ferris State University, and their employers. Therefore, there was no review of literature because none was available that fit those parameters.

"Population": Survey instruments were sent to those graduates whose names appeared on the Alumni listing of Heavy Equipment Service Program Graduates. The 1988 graduates were screened and not sent surveys if they were known to be pursuing further studies. There were also eight surveys, 2.1% of the total returns, that were invalid because of being returned blank, containing inconsistant data, or were Alumni listing errors.

"Task Inventory": The tasks listed in section 4 of the survey instrument are not all taught in the present Heavy Equipment Program, nor is the list all inclusive of what is presently taught. These tasks are the ones that were thought to be critical or changing in the industry.

"Factory Schools Attended": The questions pertaining to the profiles of the industries for which the graduates work does contain some margin of error. The factory or industry schools attended by the graduates are listed under the industry where they are presently employed. Since the graduates have had an average of approximately two jobs, and 37% changed industries, the potential for error increases. Therefore some low frequency and seemingly unrelated courses may appear in an industry classification.

SECTION II

RESEARCH PROCEDURES

* Population and Sample *

The population was 644 graduates of the Heavy Equipment Service Program at Ferris State University between the years of 1978 and 1988. A pilot sample was selected from a graduate listing, alphabetical by year, for the years 1978 through 1986. It should be here noted that the initial study was to span those years but was expanded to 1988 when the survey forms were distributed. The average class size for those nine years (1978 - 1986) was 69 graduates. Therefore, graduate number 35 (the approximate class middle) was selected to receive a pilot sample. Four of the nine samples sent were returned. The survey instrument was redesigned in the area of additional degrees (questions 16 and 19) to facilitate computer analysis. A second pilot sample was distributed, this time to student number 36 on the list. Two responded from the nine that were distributed. Identification numbers were then assigned to each of the 644 graduates that were to receive the survey questionnaire.

<u>Development of Survey Instrument</u>

The survey instrument was mostly developed from a list of questions which are quite frequently asked by students, future students, and their parents about the Heavy Equipment Program at Ferris State University. The task analysis section of the instrument was developed to establish a correlation between the tasks and the type of industries that employ the graduates.

Once the questions were developed, the instrument was studied for ease of data retrieval and analysis. Dr. Fred Swartz and Ms. Linda Burns at the Ferris State University Testing Center were very helpful with their suggestions on how to improve the survey instrument. Many hours of analysis were saved by their suggestions.

The test instrument was then given to several faculty members of the Heavy Equipment Service Program for input and comments. A few suggestions were incorporated.

The respondents from the two pilot programs indicated no major problems with understanding or completing the survey instrument. Therefore, the survey instrument was considered ready for data collection. Appendix I contains a copy of the survey instrument.

* Data Collection *

A cover letter (Appendix II), numbered questionnaire and stamped self-addressed return envelope (Appendix III) were sent to each of the 644 graduates of the Heavy Equipment Program. A request for address correction from the United States Postal Service was also stamped on each envelope sent. When surveys were returned from the U.S. Postal Service with the address corrections (20), they were immediately sent back out in a new envelope with the corrected address. After eight weeks, 276 surveys had been returned. However, of that number 14 were returned by the U. S. Postal Service with no forwarding addresses. Since these 14 would not be receiving a survey, the total population was reduced by that number to 630 for purposes of calculating the percent of returns.

A second mailing with a cover letter (Appendix IV) and another numbered questionnaire with a stamped self-addressed return envelope were sent to the 368 non-respondents of the first mailing. After another six weeks, 112 additional responses were received. Therefore, the total response for the entire study was 374 graduates. This number was reduced to 366 because eight of the surveys returned were invalid. The total return on the study was 366/630, which is 58.1%.

* Analysis of Data *

The data from the survey questionnaires were analyzed on two different computer systems. A majority of the information that required intricate data crosses was analyzed on a "Statistical Package for Social Sciences" (S.P.S.S.) program on the University's IBM 3083 main frame computer. The curriculum changes, comments and data from those working in the education field were analyzed on a Zenith personal computer using a "P.C. File Plus" program.

Question number 3 on the survey instrument was discarded. There were several respondants who changed their answers as well as several others who indicated they were unemployed but indicated otherwise elsewhere in the survey. This question was for some reason misleading, therefore, the validity of the information is too questionable for consideration.

The appendix of this report contains all the data compiled from the survey. The information is arranged in a frequency of response format with percentage of total or change calculations as indicated. While some of the data is not used to specifically address research questions, it has been included as supplemental information for possible future studies.

The tables in the "Report of Findings" section of this report are condensed versions of the data found in the appendices following the table number. Since these tables contain only significant frequency responses, the reader may want to refer to the indicated appendix number if a complete listing of all the data is desired.

A very important result of both the graduate and industry profiles was the changes that additional degrees had on them. Therefore, the data in the tables and appendices may be of one of three types; all graduates, those with just a Heavy Equipment degree, and those with a Heavy Equipment degree plus additional degree(s). The additional degree(s) may be another associates, a bachelors, a masters or any combination thereof.

For analizing industry fit to the task inventory list, a system of averages was used. The fit for each industry was determined by the averages of all the tasks in that industry. The individual tasks and the total averages will range from a low of zero to a high of three. This may appear to be inconsistent with the questionnaire responses which range from one to four. However, for analysis, the computer automatically reduced the responses by one, generating a zero through three system. The zero through three analysis was the original intent of this study, however, the presence of a zero on the task inventory section was thought to perhaps influence a response away from the never category. Therefore one through four was used on the task inventory list.

The purpose of the task inventory was to identify those tasks which are considered important to an industry. With one and two hypothetically set as the lower and upper limits of the average category, any averages below one are perhaps no longer needed in the curriculum for that particular industry. Those above two are perhaps very important to that industry and should be emphasized or included in the curriculum for that particular industry. It should be further stressed that because an average goes below one does <u>not</u> mean elimination! That particular task may be important for basic understanding and very important to the overall educational process. Using these guideposts, we then can measure how well a particular industry fits the task inventory list of the questionnaire. That fit is the task profile of the industry.

SECTION 3

REPORT OF FINDINGS

*** RESEARCH QUESTION #1 ***

What is the work profile of the Graduates of the Heavy Equipment Program?

[Q 1.1] What is the experience level of the graduates who responded to the survey?

The distribution of the graduates appears to be quite well balanced as is indicated in Table 1 and Appendix V.

Table 1

Distribution of Responding Graduates by Year Graduated

Yr Grad	78	79	80	81	82	83	84	85	86	87	88
% Resp	9.0	9.5	11.5	14.8	10.1	9.5	10.1	8.2	5.7	5.5	3.8

The peak year is 1981, with 14.8% of the respondents graduating. Before and after that year, the percentage gradually tapers off. Therefore a majority of the data in this study centers on graduates with approximately seven years experience. A few responses were received from graduates of years prior to 1978, due to errors on the Alumni listing. Also, questionnaires were not sent to 1988 graduates who were known to be pursuing additional degrees. Therefore, the population of 1988 graduates is far less than other years.

[Q 1.2] How many different jobs have the graduates worked at since graduation?

The overall average number of jobs for all the respondents of this study is 2.27. The data in Table 2 and Appendix VI indicates the distribution of the average number of jobs by year of graduation.

Table 2

Average Number of Jobs Held for Each Year of Graduation

Yr Grad	78	79	80	81	82	83	84	85	86	87	88
# Jobs	3.0	2.6	2.6	2.9	2.7	2.9	2.1	1.5	1.4	1.4	1.2

The data is consistant with what one would expect: The longer the graduates are in the work force, the more jobs they will have.

[Q 1.3] <u>How many graduates are presently unemployed?</u>

A good accounting of this information was unobtainable. There were several questionnaires received marked yes, as being unemployed, when other responses on the instrument indicated that they were currently employed. Also, on several of the questionnaires, a yes was initially marked and then changed to a no. Obviously, question number 3 on the survey instrument was confusing and the data thereof has been regarded as inaccurate.

[Q 1.4] <u>What type of jobs do the graduates presently hold?</u>

Table 3 contains the data of 92.3% of the total respondents listed in Appendix VII. Combining some of these categories provides a much clearer picture of the population. The top catagory is that of service technician, where 43.2% of our graduates are employed. Combining the service manager and shop foreman catagories yields 12.8% of the graduates working in the traditional dealership service management positions. Combining factory service representative, middle management, top management, and business owner categories indicates that 22.4% are working in a more traditional

TABLE 3

Type of Job Presently Held

Job	Number of Grads	% of Total Grads
Service Technician	158	43.2
Factory Service Rep.	30	8.2
Shop Foreman	26	7.1
Middle Management	26	7.1
Service Manager	21	5.7
Business Owner	20	5.5
Engineering Technician	11	3.0
Engineering	9	2.4
Sales	8	2.2
Parts Manager	7	1.9
Top Management	6	1.6
Driver/Equipment Operator	6	1.6
Instructor	5	1.4
Service Advisor	5	1.4

business type of management. Finally, combining the engineering and engineering technician catagories puts 5.4% of the graduates working in an engineering related field.

[Q 1.5] The graduates are presently employed in what type of business?

Nearly one third, 32.2%, of the total graduates work for some type of retail distributor. Second on the list is manufacturers who employ 21.9% of the graduates. Table 4 is

Table 4

Type of Business of Present Employer

Business	Number of Grads	% of Total Grads
Retail Distributor	118	32.2
Manufacturer	80	21.9
User Shop	30	8.2
Trucking	18	4.9
Rental Leasing	16	4.4
Independent Repair Shop	14	3.8
Municipality	10	2.7
Specialty Shop	9	2.4
Contractor	9	2.4
Busses	8	2.2
Fleet Operation	8	2.2
Military	8	2.2
Educational Institution	7	1.9
Utilities Company	4	1.1

a listing of the type of businesses which when combined employ 92.5% of the total graduates listed in Appendix VIII.

[Q 1.6] The graduate's present employer is part of what type of industry?

Table 5 is a partial listing of the industries that when combined employ 94.5% of the total graduates. See Appendix IX for a complete listing.

Table 5

Type of Industry Present Employer Serves

Industry	Number of Grads	% of Total Grads
Trucking	117	32.0
Automotive	101	27.6
Construction	73	19.9
Agricultural	19	5.2
Other	9	2.4
Military	8	2.4
Maintenance (Plant)	8	2.2
Forestry	6	1.6
Oil and Gas	5	1.4

Nearly one third, 32.0%, of the graduates have jobs that in some way serve the trucking industry. Over one quarter, 27.6%, work in an automotive related industry while nearly one out of five, 19.9%, are employed by businesses in the construction industry. Closely related functionally to the construction industry is the forestry industry. However, this industry only employs 1.6% of the graduates. The agriculture industry is fourth on the list with 5.2% of the graduates.

[Q 1.7] <u>What types of jobs do the graduates hold in the various types of businesses?</u>

The top four jobs and business types are listed in Table 6.

Table 6

The Top Present Jobs Held by Type of Business

Business Type	Jobs: Service Tech.	Jobs: Factory Serv. Rep.	Jobs: Business Owner	% of Total Grads
Retail Dist.	68			18.6
Manufacturer		29		7.9
Contractor			23	6.3
User Shop	18			4.9

Appendix X contains a complete listing of all responses with a frequency greater than three. As one might expect, service technician is the most popular job with 18.6% working for retail distributors and another 4.9% working in user shops. Factory service representatives working for manufacturers is second at 7.9%. The third job, that of business owner, accounts for 6.3% of the graduates owning their own construction businesses.

[Q 1.8] How are the types of businesses for which the graduates work distributed by type of industry?

Table 7 is a partial list that contains the four most popular types of businesses and the type of industry they serve. For a complete listing of all responses with frequencies greater than three, see Appendix XI.

Table 7

The Top Types of Businesses by Type of Industry

Industry	Business: Retail Dist.	Business: Mfg.	% of Total Graduates
Automotive		51	13.9
Construction	37		10.1
Trucking	31		8.5
Automotive	29		7.9

At 13.9%, the manufacturing business in the automotive industry employs the highest percentage of the graduates. The retail distributor business is shared quite equally by the construction, trucking, and automotive industries.

[Q 1.9] <u>What is the distribution of the jobs that the graduates presently hold by industry?</u>

A little more than one out of five, 21.3%, of the heavy equipment graduates work as service technicians in the trucking industry. Table 8 contains a listing of the top four jobs and industries while Appendix XII lists all those with a frequency response greater than three.

Table 8

The Top Present Jobs Held by Type of Industry

	Jobs		
Industry	Service Technician	Factory Serv. Rep.	% of Total Graduates
Trucking	78		21.3
Construction	40		10.9
Automotive		23	6.3
Automotive	16		4.4

Second on the list is the construction industry with 10.9% of the graduates working as service technicians. The automotive industry holds the third and fourth positions with factory service representatives at 6.3% and service technicians at 4.4%.

[Q 1.10] <u>How many graduates have changed industries from their first to their present jobs?</u>

Table 9 is a listing of the top four industries which employ 84.7% of the responding graduates while Appendix XIII contains all the industries with a frequency greater than three.

Table 9

Industry Changes from First to Present Jobs for the Top Four Industries

Industry	Graduates: Total in Industry	Graduates: Number Changed	Percent Changed
Trucking	117	31	26.5
Automotive	101	47	46.5
Construction	73	28	38.4
Agricultural	19	7	36.8

The automotive industry has the largest percentage of change which is 46.5%. The lowest is the trucking industry at 26.5%. This essentially means that the trucking industry is better at holding the graduates in their industry.

[Q 1.11] <u>How many of the graduates who served internships accepted a position with the firm with whom they interned?</u>

The graduates who served internships were separated by industry. The four industries that have the largest number of graduates are listed in Table 10 while Appendix XIV contains a complete listing.

<u>Table 10</u>

<u>Graduates who Accepted a Position with Internship Company</u>

Industry	Graduates with Internships: Total Number	Accepted Position	% Accepted
Automotive	57	19	33.3
Trucking	26	6	23.1
Construction	20	8	40.0
Other	15	3	20.0

The range runs from a high of 40% for the construction industry to a low of 20.0% in the other category. An average for these four industries would be 29.1%.

[Q 1.12] How many of the graduates who are teaching accepted a position in the school system in which they student taught or interned?

Of the five graduates who are teaching, none of them accepted a position with the school system where they student taught or interned.

[Q 1.13] How many of the graduates are presently working on additional degrees and what types are they pursuing?

Table 11 and Appendix XV lists the various types of degrees which the graduates are pursuing. Forty-five or 12.3% of the graduates are pursuing additional degrees. Nine, or 20% of those pursuing additional degrees are working on another associates degree. Those working on a bachelors accounts for 23, or 51.1% of the total. Finally, there are 13, or 28.9%, working on some type of masters degree program.

The most common degree the graduates are pursuing is business, with twenty-two or 48.4%. Engineering is the second most common type with 17.7% of the graduates pursuing degrees in that discipline.

Table 11

Types of Additional Degrees Graduates Are Pursuing

Degree Level	Degree Type	Number	% of Total
Associates			
	Other	3	6.7
	Auto Service	2	4.4
	Business	2	4.4
	Engineering	2	4.4
	Totals	9	20.0
Bachelors			
	Business	11	24.4
	Engineering	5	11.1
	AHM	3	6.7
	Teaching	3	6.7
	Other	1	2.2
	Totals	23	51.1
Masters			
	Business	9	20.0
	Other	2	4.4
	Engineering	1	2.2
	Teaching	1	2.2
	Totals	13	28.9

[Q 1.14] What is the geographic location of the graduates' present employer?

The most common states where the graduates are working are listed below in Table 12. Appendix XVI contains a complete distribution of the graduates responding by state.

Table 12

Geographic Location of Graduates Present Job

State	Number	% of Total
Michigan	297	82.3
Indiana	8	2.2
California	5	1.4
Florida	5	1.4
Ohio	5	1.4
Wisconsin	5	1.4
Colorado	4	1.1
Texas	4	1.1

Michigan has retained 82.3% of the heavy equipment graduates who responded.

<u>* RESEARCH QUESTION NO. 2 *</u>

<u>What is the profile of the industries in which the Graduates of the Heavy Equipment Program presently work?</u>

[Q 2.1] <u>Which industries offer an internship program?</u>

Table 13 establishes that the automotive, trucking, construction, agricultural, forestry and marine industries all have offered some type of internship program to the Heavy Equipment Graduate.

<u>Table 13</u>

<u>Distribution of Industries Offering Internship Programs</u>

Industry	Total Number of Internships	% Total Internships
Automotive	57	46.4
Trucking	26	21.1
Construction	20	16.3
Other	15	12.2
Agriculture	2	1.6
Forestry	2	1.6
Marine	1	0.8

There were more graduates serving internships in the automotive industry than in the trucking, construction, agriculture, forestry and marine industries combined!

Heavy Equipment Technology,

Heavy Equipment Service Engineering Technology

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[Q 2.2] <u>Which industries are the most supportive of trainee programs?</u>

Approximately one-third, 32.2%, of the responding graduates have served in some type of formal trainee program. Table 14, which is the graduate totals from Appendix XVII, lists these graduates by industry.

Table 14

Type of Industries Supporting Trainee Programs

Industry	No. of Grads. In Industry	No. of Grads. As Trainee	% Industry has Trainee
Construction	73	33	45.2
Trucking	117	43	36.8
Automotive	101	37	36.6
Forestry	6	2	33.3
Agriculture	19	3	15.8

By comparing the number of graduates who served as a trainee with the total number employed in the industry, insight may be gained as to which industries are the most supportive of trainee programs.

The range extends from a high of 45.2% of the graduates serving as trainees in the construction industry, to a low of 15.8% for the agricultural industry.

[Q 2.3] What is the average time that the graduates worked as trainees?

The time responses for each industry were evaluated using a method of weighted averages. The results of this evaluation are charted in Table 15 and Appendix XVIII.

Table 15

Average Time Graduates Served as Trainees by Industry

Industry	Total (Months) <1	1-6	7-12	>12	Weighted Average
Trucking	13	23	2	5	1.98
Automotive	8	18	5	6	2.24
Construction	9	13	3	8	2.30
Agriculture	1	-	-	2	3.00
Forestry	1	1	-	-	1.50

The weighted results range from a low of 1.50 for the forestry industry to a maximum of 3.00 for agriculture. These two figures appear to be extreme values because of the low frequency of responses. So the range is more realistically 1.98 for trucking to 2.30 for construction with the automotive industry falling in the middle at 2.24. These weighted averages mean that the average time that the graduates worked as trainees falls in the 1-6 months range.

[Q 2.4] What percentage of the graduates have received industry training?

Looking at the number of graduates receiving training by industry and comparing these figures with the total number of graduates in each industry, establishes a training percentage. Table 16 and Appendix XIX indicate the percentage values for each industry.

Table 16

Percent of Graduates
Receiving Industrial Training by Industry

Industry	No. Grads in Industry	No. Grads Who Received Training	% Grads Who Received Training
Construction	73	52	71.2
Trucking	117	73	62.4
Agricultural	19	12	62.2
Forestry	6	3	50.0
Automotive	101	40	39.6

The values range from a low of 39.6% for the automotive industry to a high of 71.2% for the construction industry. The overall average for the industries listed in table 16 is 57% receiving additional training.

[Q 2.5] <u>How long did the graduates work before receiving some type of industry or factory training?</u>

The time responses for each industry were again evaluated using the method of weighted averages. The results are charted in Table 17 and Appendix XX.

<u>Table 17</u>

<u>Time Worked Before Attending Industry Schools</u>

Industry	Time (Months)						Weighted Average
	<1	1-6	7-12	13-18	19-24	>24	
Trucking	7	16	18	6	7	19	3.64
Automotive	12	23	13	3	1	8	2.70
Construction	7	10	15	4	2	14	3.50
Agriculture	3	1	4	1	1	2	3.17
Forestry	-	-	1	-	-	2	5.00

The averages range from a low of 2.70 for the automotive industry to a high of 5.00 for forestry. This means that the graduates working in the automotive industry fall in the 1-6 month range. Agriculture, construction and trucking all fall in the 7-12 month range. In the forestry industry, the average indicates that the graduates work 19 - 24 months before receiving factory training. However, the accuracy of this average is quite questionable because of such a low frequency of response. An overall average for the four industries, excluding forestry, would be 3.25, or 7 - 12 months.

[Q 2.6] In comparing the industries that employ the Heavy Equipment graduate, which provide the most training?

This question is answered best by comparing the number of industry courses the graduates have completed with the total number of graduates working in the industry. This course to graduate ratio is charted in Table 18 and Appendix XXI.

Table 18

Courses Per Graduate Ratio by Industry

Industry	No. Grads in Industry	No. of Courses	Course per Grad. Ratio
Automotive	101	152	1.50
Agriculture	19	24	1.26
Construction	73	72	0.99
Trucking	117	96	0.82
Forestry	6	3	0.50

The automotive industry has the highest ratio offering 1.50 courses per graduate in the industry. The lowest is forestry at .50 courses per graduate, or one out of two graduates are trained. Trucking and construction fall close to one course per graduate.

[Q 2.7] What types of industry or factory training have the graduates received?

If the reader wishes to inspect the data in it's more detailed state, a grouping of those courses with a frequency response of three or more, in descending order, is contained in Appendix XXII. A complete alphabetized list of all the training courses taken by the graduates is contained in Appendix XXIII. The codes for identifying the industry, business and type of job of the graduates taking the courses in the alphabetized list may be found in Appendix XXIV. Table 19 is a delineation of the data contained in Appendicies XXII and XXIII. By further grouping the related courses, a much clearer picture of the Heavy Equipment Industry trends emerges. The grouped courses in Table 19 represents 92.3% of the total responses.

Table 19

Type of Industry Training (all Graduates)

Course	Number	% Totals
Product Training	74	19.7
Engine Related	68	18.1
Fuel System Related	52	13.8
Management Related	36	9.6
Transmissions	29	7.7
Refrigeration - A/C	24	6.4
Electrical	24	6.4
Hydraulics Related	14	3.7
Drivetrains	13	3.5
Brakes & Suspension	13	3.5

At the top of the list with 19.7% of the courses is specific product training. Second at 18.1% is some type of engine course with third place being closely related engine fuel systems.

[Q 2.8] What were the top three training courses offered to the graduates in the various industries?

Table 20 is condensed from Appendices XXV, XXVI, XXVII and XXVIII.

Table 20

The Top Three Training Courses Offered by Each Industry

Industry and Training Course	Number Offered	% of Courses Offered by Each Industry
Trucking		
Diesel Engines	23	24.0
Transport Refrigeration	14	14.6
Product Training	11	11.5
Totals:	48	50.1%
Automotive		
Product Training	17	11.2
Diesel Engines	12	7.9
Electrical	12	7.9
Totals:	41	27.0%
Construction		
Product Training	25	34.7
Diesel Engines	13	18.1
Hydraulics	6	8.3
Totals:	44	61.1%
Agricultural		
Product Training	13	54.2
Diesel Engines	4	16.7
Drivetrains	1	3.2
Totals:	18	75.1%
Forestry		
Hydraulics	2	66.7
Electrical	1	33.3
Totals:	3	100.0%

Product training was the most common type of training offered by the automotive, construction and agricultural industries. However, it is quite interesting that product training was out-ranked by both the diesel engine and transport refrigeration courses in the trucking industry.

Diesel engines ranked second in the automotive, construction and agriculture industries.

Hydraulics ranked in both the construction and forestry industries with electrical being common to the forestry and automotive industries.

[Q 2.9] Of the graduates who are teaching, what is the type of educational institution for which they teach?

Five of the graduates responding are presently working in the teaching profession. Table 21 is an accounting of the type of institution for which they teach.

Table 21

Type of Institutions for Which Graduates Teach

Institution	No. Graduates
Manufacturer	1
Career Center	2
Community College or J.C.	2

[Q 2.10] <u>Of the graduates who are teaching, what types of courses do they teach?</u>

Since there are so few in the teaching profession, all the courses they teach and the number teaching them are listed in Table 22.

<u>Table 22</u>

<u>Type of Courses Graduates are Teaching</u>

Course	No. Grads Teaching Course
Electrical	2
Transmissions	2
Basic Engine Repair	1
Chassis and Drive Train	1
Welding	1
All Automotive Classes	1
Fuel Injection (gas)	1
Air Conditioning	1
Hydraulics	1
Service Floor	1
Truck Maintenance	1
Truck Automatic Transmissions	1
Drive Trains	1
Brakes and Suspension	1
Engine Rebuild	1
Fuel Injection (Diesel)	1

[Q 2.11] <u>What are the various industries' fit to the survey task inventory?</u>

The purpose of the task inventory is to identify those tasks which are important and those which are not for each industry. It must be mentioned again that the purpose of this inventory is <u>not</u> to support the addition or elimination of courses or course content; but, it is to be used to identify areas which need further study. Another benefit of this analysis is the identification of those tasks that are common to the various industries. Table 23 is a duplication of Appendix XXIX and is included here for the convenience of the reader. The number in the body of Table 23 is the measure of the importance of a task to a particular industry. The number represents the average of all the graduates responses on a graduated Likert-type scale. The range of the scale is from zero, indicating no importance, to three, which signifies great importance. The following number line was arbitrarily developed to be used as a gauge.

```
| Insignificant  |      Average      |   Important    |
|     Range      |       Range       |     Range      |
|----------------|-------------------|----------------|
0                1                   2                3
```

For example; LP gas engine overhaul for the agriculture industry received an average reading of 0.25. This number falls very close to the lower end of the insignificant range and should be studied further before making any curriculum decisions. Some of the information that falls in the

TABLE 23

TASKS	AG	AUTO	CONST.	FORESTRY	TRUCK	OTHER	SUM	AVG
Air Brakes T-Shooting	1.20	.48	1.51	1.83	2.32	.81	8.15	1.36
Hydraulic Brakes T-Shooting	1.70	1.42	1.63	2.00	1.42	.84	9.01	1.50
Rebuild Major Brake Components	1.30	.89	1.67	1.33	1.75	.77	7.71	1.29
Turn Brake Drums or Rotors	.25	1.16	.52	.17	.73	.45	3.28	.55
A/C Sys T-Shooting	1.85	1.40	.73	.50	1.73	.37	6.58	1.10
A/C Component Rebuild	.30	.61	.33	.17	.53	.23	2.17	.36
Diesel Engine Overhaul	2.10	.76	1.95	1.83	1.77	.88	9.29	1.55
Gasoline Engine Overhaul	1.85	1.26	1.31	1.50	1.14	.79	7.85	1.31
LP Gas Engine Overhaul	.25	.13	.28	.00	.38	.29	1.33	.22
Diff. Cone Point Setting	.65	.35	1.05	.67	.58	.22	3.52	.59
Rebuild Planetary Hubs	1.10	.40	1.67	1.67	.40	.40	5.64	.94
Carbeuration Sys. T-Shooting	1.95	1.40	1.28	.83	1.21	.90	7.57	1.26
Carbeurator Overhaul	1.85	1.13	1.05	1.00	.91	.88	6.82	1.14
Diesel Inj. Sys. T-Shooting	2.25	.95	2.00	2.33	2.05	1.09	10.67	1.78
Diesel Inj. Clean & Setting	1.55	.50	1.27	1.83	1.14	.62	6.91	1.15
Diesel Inj. Pump Overhaul	.25	.30	.52	.33	.32	.35	2.07	.35
Diesel Inj. Pump Calibration	.20	.27	.55	.00	.42	.33	1.77	.30
Electronic Fuel Inj. Service	.50	1.41	.31	.33	.61	.35	3.51	.59
Electrical Lighting T-Shooting	2.50	1.62	2.26	2.83	2.57	1.31	13.09	2.18
Elec. Start & Charge T-Shoot	2.50	1.70	2.42	3.00	2.54	1.42	13.58	2.26
Electrical Ignition T-Shooting	2.10	1.64	1.71	2.17	1.70	1.11	10.43	1.74
Elec. Computer Control T-Shoot	.45	1.67	.89	1.00	.84	.84	5.69	.95
Gen./Alternator Rebuild	1.20	.84	.82	1.17	.43	.65	5.11	.85
Starter Rebuild	1.10	.73	.86	1.50	.37	.44	5.00	.83
Electronic Ignition Systems	.75	1.52	.76	1.00	1.06	.72	5.81	.97
Ignition Sys. Scope Analysis	.10	1.16	.26	.17	.39	.32	2.40	.40
Hydraulics T-Shooting	2.30	.79	2.50	2.50	1.36	1.37	10.82	1.80
Hydraulics Component Rebuild	2.05	.51	2.27	2.50	.83	1.13	9.29	1.55
Manual Transmission Rebuild	1.55	.89	1.34	.67	1.21	.58	6.24	1.04
Automatic/P.S. Trans. T-Shoot	1.40	1.14	1.57	.67	.89	.68	6.35	1.06
Automatic/P.S. Trans. Rebuild	1.10	.81	1.28	.33	.47	.47	4.46	.74
Hydrostatic Trans. T-Shoot	1.45	.23	1.39	1.17	.40	.65	5.29	.88
Hydrostatic Trans. Rebuild	.75	.19	.92	.83	.26	.51	3.46	.58
Suspension Sys. Alignment	.50	1.19	.59	1.17	1.59	.53	5.57	.93
Suspension Sys. Rebuild	.50	1.06	.88	1.67	1.83	.55	6.49	1.06
Front Axle Rebuild	.80	.74	1.10	1.00	1.57	.58	5.79	.97
Pin & Bush Track Systems	.30	.19	1.38	1.50	.32	.32	4.01	.67
TOTALS (SUM)	44.50	33.44	44.83	45.17	40.04	24.75	232.73	38.82
TOTALS (AVG)	1.20	.90	1.21	1.22	1.08	.67	6.29	1.05

insignificant range may not be currently used in the field but may be very important to basic understanding. Such information must therefore be retained in the curriculum regardless of its rating. Another example is Hydraulics troubleshooting in the forestry industry. With a rating of 2.50, it falls mid-range of the important range, indicating that this task is important to that industry. Lastly, let us consider starter rebuilding for the forestry industry. With a rating of 1.50, it falls mid-range of the average range, indicating that it is a task of average importance.

At the bottom of each industry column is a totals (Avg.) number. This number is an average of all that industries' task ratings and when positioned on the zero to three range Likert-type scale previously described, is a measure of the industry fit to the task list.

The agriculture, construction, forestry and trucking industries all had a total average that fell on the lower end of the average range of the scale. The automotive and other industries were down in the insignificant range indicating a poor fit to the task list. With a more detailed analysis of Table 23, the reason for these low ratings are more apparent. Separating out the number of tasks that fell into each of the three ranges, gives one a much clearer picture. Table 24 indicates the percentage of all the tasks that fell into each range for each industry.

Table 24

Percent of Industry Tasks in each Range by Industry

	Percent of Industry Tasks					
Range	Ag.	Auto	Const	Forestry	Truck	Other
Important Range	19.0	0.0	13.5	19.0	10.8	0.0
Average Range	40.5	43.2	46.0	43.2	37.8	16.2
Insignificant Range	40.5	56.8	40.5	37.8	51.4	83.3

Neither the automotive or other industries have any tasks that are rated in the important range (above 2.0). Also both have a high percentage of their tasks rated in the insignificant range (less than 1.0). This data essentially says that the tasks performed in the Heavy Equipment Industry are different from those required for automotive and the others industries.

In order to improve the task fits for the agricultural, construction, forestry and trucking industries one needs to look closely at those tasks that fall in the insignificant range. The effect of eliminating those in the insignificant range (<1.0) may be seen by comparing the fit with those tasks greater than 1.0 and looking at percentage of change. Table 25 compares the overall avg. (fit) of these industries with the average of those tasks greater than 1.0.

Table 25

Effect on Industry Fit by Eliminating those Tasks in the Insignificant Range

Fit	Industry			
	Ag.	Const.	Forestry	Truck
Overall Avg. (fit)	1.20	1.21	1.22	1.08
Avg. of Tasks >1.0	1.73	1.55	1.72	1.66
% Change	+44.17%	+28.10%	+40.98%	+53.70%

This closer analysis indicates that if those tasks in the insignificant or less than 1.0 range were eliminated, there would be a very positive effect on the industry to task inventory fit. An improvement from 28 to 53% may be .ealized, depending upon the industry.

[Q 2.12] What are the most important tasks in the task inventory list?

Referring again to Table 23, the avg. column along the right margin is the average of the task ratings across the row. This number measures the importance of that task with respect to all industries. Table 26 is a listing of the top ten tasks in decending order of overall average.

Table 26

Top Ten Ranked Tasks with Respect to all Industries

Task	Industry Avg. (All)
Electrical Start & Charging Troubleshooting	2.26
Electrical Lighting Troubleshooting	2.18
Hydraulics Troubleshooting	1.80
Diesel Injection System Troubleshooting	1.78
Electrical Ignition Troubleshooting	1.74
Diesel Engine Overhaul	1.55
Hydraulics Component Rebuild	1.55
Hydraulic Brakes Troubleshooting	1.50
Air Brakes Troubleshooting	1.36
Gasoline Engine Overhaul	1.31

It is quite interesting that seven out of the 10 top ranked tasks are related to some type of troubleshooting.

[Q 2.13] Which of the important tasks were common to the Heavy Equipment Industries?

Another benefit of Table 23 is the identification of those tasks that are common to the various industries.

Table 27

Common Heavy Equipment Industry Tasks Rated as Important

Task	Industry			
	Ag	Const	Forestry	Truck
Electrical Start & Charging Troubleshooting	*	*	*	*
Electrical Lighting Troubleshooting	*	*	*	*
Diesel Injection System Troubleshooting	*	*	*	*
Hydraulics Troubleshooting	*	*	*	
Hydraulic Components Rebuild	*	*	*	
Electrical Ignition Troubleshooting	*		*	
Diesel Engine Overhaul	*			
Hydraulic Brakes Troubleshooting			*	
Air Brakes Troubleshooting				*

These common tasks will serve as a basis for further study with industry to establish them as core courses in the core course concept of curriculum development. Table 27 identifies all of the tasks which fell in the important range (>2.0) on the Likert-type scale. The automotive and other industries are not included in Table 27 because they did not have any task averages greater than 2.0. Table 27 clearly defines two electrical troubleshooting areas and diesel injection troubleshooting as the important tasks common to all four heavy equipment industries. Hydraulics is important to all the industries except trucking.

[Q 2.14] Which of the tasks were insignificant to all industries?

As was explained earlier, any tasks that rank very low should also be studied very carefully for improving the fit of an industry to the task inventory. First consideration for study should be those tasks that had an average of less than 1.0, for all industries. Table 28 indicates those tasks in the insignificant range with an average less than 1.0, for all industries.

Table 28

Tasks Which have an Average in the Insignificant Range for all Industries

Task	Industry Avg. (all)
A/C Component Rebuild	0.36
L.P. Gas Engine Overhaul	0.22
Diesel Injection Pump Overhaul	0.35
Diesel Injection Pump Calibration	0.30
Hydrostatic Transmission Rebuild	0.58

[Q 2.15] Which tasks rated above the insignificant range in only one industry?

Table 29 identifies those tasks that had an average >1.0 in only one industry. That industry is also identified in the Table.

Table 29

Tasks That Rated Above the Insignificant Range in Only one Industry

Industry above Insignificant Range	Task
Automotive	Electrical fuel injection service
	Turn brake drums and rotors
	Injection system slope analysis
Construction	Differential cone point setting

Four tasks have been identified which are above the insignificant range for only one of the industries. The importance of this data is that it identifies those tasks which are peculiar or unique to only one industry.

* RESEARCH QUESTION #3 *

What is the relationship of additional degrees to the work profile of the Graduates of the Heavy Equipment Program?

[Q 3.1] What percent of the Heavy Equipment Graduates have earned additional degrees? What types of additional degrees have they earned?

Of all the graduates responding, 41.8% have earned additional degrees. These 153 graduates have earned 171 degrees. Therefore, 18 or 4.9% are multiple degrees. Table 30 and Appendix XXX list the most popular degree for each level of study.

Table 30

The Most Common Types of Additional Degrees Graduates Have Earned

Degree Level	Most Common Degree Earned	Number Earned	% of Degree Level
Associates (Second)	Auto Service	31	55.4
Bachelors	AHM (AHT)	88	79.3
Masters	Business	1	100.0

[Q 3.2] <u>What is the relationship of additional degrees to the average number of jobs held since graduation?</u>

The average number of jobs held by those who earned additional degrees is 10.6% less than those without additional degrees. For a more detailed breakdown of the data presented in Table 31, see Appendix VI.

Table 31

Relationship of Additional Degrees to the Average Number of Jobs Held

Degree Level	Average No. Jobs Held	% Change
Without additional degrees	2.37	
With additional degrees	2.13	10.6%

[Q 3.3] <u>What is the relationship of additional degrees to the distribution of graduates by the type of jobs they hold?</u>

Appendix VII is a complete listing of all the different types of jobs that the graduates presently hold. Table 32 compares the percentage of graduates without additional degrees with the percentage of graduates with additional

Table 32

Comparison of Graduate Job Distribution to Additional Degrees

Job	Without Add'l Degrees # Grads	Without Add'l Degrees % Group	With Add'l Degrees # Grads	With Add'l Degrees % Group	% Change in Group
Service Tech	125	58.7	33	21.6	63(-)
Factory Serv Rep	2	0.9	28	18.3	1933
Shop Foreman	17	8.0	9	5.9	26(-)
Middle Management	10	4.7	16	10.5	123
Serv. Management	12	5.6	9	5.9	5
Business Owner	12	5.6	8	5.2	7(-)
Engineering Tech.	7	3.3	4	2.6	21(-)
Engineer	2	0.9	7	4.6	411
Sales	2	0.9	6	3.9	333
Parts Manager	4	1.9	3	2.0	5

degrees for the top ten jobs listed in Appendix VII. Since there were 213 students without additional degrees and 153 with additional degrees the only way to accurately compare the relationship of the additional degrees is to observe how the percent of group changes for each job by degrees. The number of graduates working as factory service representatives increased 1933% with an additional degree. However, most management related jobs also increased. The effects of the additional degrees had negative results for jobs as service technicians and shop foreman, which were the top jobs in the without additional degree group. There was a

7.1% decline in business ownership and a 21% decline in engineering technicians with advanced degrees. The percent of change was positive for the remaining jobs on the chart.

[Q 3.4] <u>What is the relationship of additional degrees to the distribution of the graduates by the type of business of their present employer?</u>

Appendix VIII is a complete listing of all the different types of businesses of the graduates present employers. There were a total of 213 graduates responding who did not receive additional degrees. However, there were a total of 153 that have received additional degrees. Table 33 compares the relationship of additional degrees on the distribution of graduates for the top ten businesses listed in Appendix VIII. The % of Group for the graduates without additional degrees is established by comparing the number of graduates responding to the business to the total of 213. Likewise, the % of Group for the graduates with additional degrees is established by comparing the number of graduates responding to the business to the total group of 153. Since the totals for each group are different, the only

Table 33

Comparison of Graduates Employers Type of Business Distribution to Additional Degrees

Business	Without Add'l Degrees		With Add'l Degrees		% Change in Group
	# Grads	% Group	# Grads	% Group	
Retail Distributor	76	35.7	42	27.5	23(-)
Manufacturer	24	11.3	56	36.6	224
User Shop	23	10.8	7	4.6	57(-)
Trucking	13	6.1	5	3.3	46(-)
Rental Leasing	13	6.1	3	2.0	67(-)
Indep. Repair Shop	12	5.6	2	1.3	77(-)
Municipality	8	3.8	2	1.3	66(-)
Specialty Shop	7	3.3	2	1.3	61(-)
Contractor	5	2.3	4	2.6	13
Busses	5	2.3	3	2.0	13(-)

way to effectively determine the effects of the additional degrees is to compare the change in the group percentages. The businesses of manufacturer and contractor are the only two on the chart that had positive percent in change with the additional degrees. The rest of the distributations were all adversely effected by additional degrees.

[Q 3.5] <u>What is the comparison of additional degrees to the distribution of graduates by the industry that their present employer serves?</u>

Appendix IX lists all the industries that the 366 graduates' present employers serve. Again, 153 of the graduates have received additional degrees and 213 have not. The top four industries contain 84.7% of all the graduates responding, therefore, only those four will be studied to determine the relationship additional degrees had on graduate distribution. As in the two previous questions, direct comparison cannot be made by the number of graduates responding because of the unequal balance between graduates "with" and "without" additional degrees. Therefore the changes in the percentages of graduates without additional degrees will be compared to the graduates with additional degrees. Table 34 indicates how the percentages of these two groups changed with the additional degrees. The percentage of graduates working in the automotive industry increased by 214% with additional degrees. However, the percentage of graduates working in the traditional Heavy Equipment fields declined with additional degrees.

Table 34

Comparison of Graduates Employers Type of Industry Served Distribution to Additional Degrees

Industry	Without Add'l Degrees		With Add'l Degrees		% Change in Group
	# Grads	% Group	# Grads	% Group	
Trucking	84	39.4	33	21.6	45(-)
Automotive	31	14.6	70	45.8	214
Construction	49	23.0	24	15.7	32(-)
Agricultural	16	7.5	3	2.0	73(-)

[Q 3.6] What types of jobs are held by graduates who have earned additional degrees?

The two main groups of the different types of degrees are the second associates and the bachelors degree. The data displayed in Table 35 compares the number of graduates with these additional degrees to their most common jobs. The most common job for all the graduates earning their second associates degree is the service technician. There are 24, or 42.9% of all the graduates earning a second associates are working as service technicians. A majority of those, 15, have received their second associates in auto service. For the bachelors degree program, the most common job was that of factory service representative. Twenty-six, or 23.4% of all

Table 35

Relationship of the most Common Types of Jobs the Graduates Hold to Type of Additional Degree Earned

Job	Additional Degree Earned						
	Auto Serv.	Auto Mach.	AHM (AHT)	Educ	Bus	Eng	Other
Second Associates							
Service Technician	15	5			1		3
Business Owner	4						3
Factory Serv. Rep.	3	1			1		
Shop Foreman	2						1
Middle Management	1				1		
Others	6	3				1	5
Totals	31	9			3	1	12
Bachelors							
Factory Serv. Rep			22	2	2		
Middle Management			13		1		
Top Management			2				
Service Technician			3	3	2	1	
Service Manager			8				
Shop Foreman			6		1		
Sales			6				
Service Advisor			5				
Business Owner			3		1		
Instructor			1	3			
Engineering Tech.			4				
Engineer			4				
Parts Manager			2				
Others			9	2	3	2	
Totals			88	10	10	3	

the graduates receiving a bachelors degree are working at that job. A majority of the bachelors degreed graduates, 79.3%, earned them in the AHM (AHT) degree program. For a complete listing of all jobs and all additional degrees, see Appendices XXXI and XXXII.

[Q 3.7] In what types of industries do the graduates with additional degrees work?

Table 36 is a breakdown of the most common industries for which the graduates work.

Table 36

Relationship of the Type of Industry to Type of Additional Degree Earned

Industry	Type Degree							
	Auto Serv	Auto Mach	AHM (AHT)	Educ	Bus	Eng	Other	Totals
Second Assoc.								
Automotive	10	4			1	1	3	19
Trucking	12	2					1	15
Construction	4	2			1		4	11
Others	5	1			1		4	11
Totals	31	9	-	-	3	1	12	56
Bachelors								
Automotive			52	1	5	1		59
Trucking			14	5				19
Construction			10	2	1	1		14
Military			2	1	1			4
Others			10	1	3	1		15
Totals	-	-	88	10	10	3	-	111

Appendices XXXIII and XXXIV contain a complete listing of all the industries employing the graduates by the type of additional degree they have earned. Out of the 56 graduates who have earned a second associates degree, 19, or 34% are working in the automotive industry, 15, or 27% are working in the trucking industry and 11, or 20% are working in the construction industry. For those graduates earning a bachelors degree 59, or 53% are working in the automotive industry. Only 19, or 17% of those earning a bachelors degree are working in the trucking industry. The construction industry is even lower with 14, or 13%. This means that 33, or slightly less than 30% of those receiving a bachelors degree remain in the Heavy Equipment Industry.

[Q 3.8] <u>How do the AHM (AHT) program graduates compare with other additional degree graduates in accepting a position with their internship company?</u>

The data in Table 37 indicates a very decisive difference in the two groups. Only 3 out of 43, or 7%, of the other graduates with additional degrees accepted a position with the firm with which they interned. Thirty-four out of 80, or 42.5%, of the graduates with AHM (AHT) degrees accepted a position with the firm for which they interned.

Table 37

Comparison of AHM (AHT) Graduates with Other Degreed Graduates in Accepting Positions with Internship Company

Industry	Other Add'l Degrees		AHM (AHT)	
	No. Grad Interns	No. Interns Accept Jobs	No. Grad Interns	No. Interns Accept Jobs
Agriculture	1	0	1	1
Automotive	12	1	45	18
Construction	10	2	10	6
Forestry	1	0	1	0
Trucking	12	0	14	6
Marine	1	0	-	-
Other	6	0	9	3
Totals	43	3	80	34

** Research Question #4 **

What is the relation of additional degrees to the industry profile of the Heavy Equipment Graduates?

[Q 4.1] **What is the relationship of additional degrees on the average time the graduates worked as a trainee in the different types of industries?**

To compare the relationship of additional degrees on time spent as trainees, the weighted average of the time ranges for the major industries was established. See Appendix XVIII for the breakdown of the various ranges for both the graduates "with" and "without" additional degrees. Table 38 compares the weighted averages for graduates "with" and "without" additional degrees.

Table 38

Relationship of Additional Degrees on Average Time Graduate Worked as a Trainee

Industry	Without Add'l Degrees Weighted Avg. (Months)	With Add'l Degrees Weighted Avg. (Months)	% Change
Construction	2.68	1.55	42(-)
Trucking	2.14	1.64	23(-)
Automotive	2.45	2.15	12(-)

In all three industries, the length of time the graduates served as a trainee decreased with additional degrees. The automotive industry changed the least at 12%, the construction industry changed the most at 42%, and trucking was in the middle with a 23% change.

[Q 4.2] What is the relationship of additional degrees on how long a graduate worked before receiving some type of industry or factory training?

Again, a weighted average of the time ranges in Appendix XX was compared for the major industries. In Table 39, the relationship of additional degrees on the time worked before receiving training is charted.

Table 39

Relationship of Additional Degrees on the Average Time A Graduate Worked Before Receiving Industry Training

Industry	Without Add'l Degrees Weighted Ave. (Months)	With Add'l Degrees Weighted Ave. (Months)	% Change
Trucking	3.87	3.10	20(-)
Construction	3.55	3.42	4(-)
Automotive	2.56	2.75	7

It is quite interesting that the time worked before attending a factory school actually increased for those working in the automotive industry. The time worked decreased in the trucking and construction industries. It should be noted that any comparisons for the agriculture and forestry industries were omitted because of the low frequencies of response. See appendix XX for these industries.

[Q 4.3] What is the relationship of additional degrees on the type of industry or factory schools the graduates attended?

The courses listed in Appendix XXII were again grouped into related courses and then split into "with" and "without" additional degrees categories. Comparing the course frequencies of these two categories allows comparisons to be made about the relationship of the additional degrees on the type of schools attended . Table 40 lists the data in decending rank of rate of change. Management related courses surpassed all others with a 700% increase for those who have additional degrees. These data are also important for identifying new or changing technology, as the 48% increase in fuel system related courses indicate. Large reductions

Table 40

Relationship of Additional Degrees on Type of Factory Schools Graduates Attended

Courses	Without add'l Degrees Number	With Add'l Degrees Number	% Change
Management Related	4	32	700
Fuel System Related	21	31	48
Transmissions	13	16	23
Electrical	11	13	18
Product Training	39	35	10(-)
Drive Trains	7	6	14(-)
Brakes and Suspensions	8	5	38(-)
Engine Related	44	24	45(-)
Refrigeration - A/C	17	7	59(-)
Hydraulics Related	11	3	73(-)

occur in those courses that are traditionally Heavy Equipment courses. This information is very important for confirming trends and assisting with curriculum development.

[Q 4.4] What is the relationship of additional degrees on the industries fit to the survey task inventory?

Two comparisons are again necessary to measure the industry fit to the survey task inventory. The first is to observe any change in the industry column averages of the "without" (Appendix XXXV) and "with" (Appendix XXXVI) additional degrees. The second measure to compare is the top ranking tasks between the "with" and "without" additional degrees groups. Table 41 is a listing of the changes that occurred in the industry column total task averages.

Table 41

Relationship of Additional Degrees on Industry Fit to Survey Task Inventory

Industry	Without Add'l Degrees Total task Average	With Add'l Degrees Total task Average	% Change
Forestry	1.20	1.32	10
Trucking	1.04	1.13	9
Automotive	0.88	0.93	6
Construction	1.29	1.08	16(-)
Agriculture	1.24	0.93	25(-)

The forestry industry had a 10% increase, which indicates that those with additional degrees have a 10% better fit to the task inventory list. At the opposite end of the spectrum, the agricultural industry has a decreasing change of 25%, which indicates that those without any additional degrees fit the task inventory list 25% better than those with additional degrees.

These changes are primarily caused by the shifting of the frequency of tasks that fall in the insignificant

(<1.0), average (>1.0 <2.0) and important (>2.0) ranges. Table 42 compares the percentage of distribution of the tasks in each range for the graduates "with" and "without" additional degrees.

Table 42

Change in Relative Importance of Tasks Relating to Graduates with and Without Additional Degrees Reported by Industry

Task Importance	Industry				
	Ag	Auto	Const	Forestry	Truck
Important					
Without	19.0%	0%	16.2%	21.6%	5.9%
With	16.2%	0%	5.4%	35.1%	3.5%
Change	(-)		(-)	(+)	(+)
Average					
Without	40.5%	43.2%	46.0%	32.4%	43.2%
With	29.7%	46.0%	51.4%	37.8%	40.5%
Change	(-)	(+)	(+)	(+)	(-)
Insignificant					
Without	40.5%	56.8%	37.8%	46.0%	51.4%
With	54.1%	54.0%	43.2%	27.1%	46.0%
Change	(+)	(-)	(+)	(-)	(-)

With the exception of the agricultural industry, the average range remained fairly constant with only slight changes in the concentration of the tasks in the "with" and "without" additional degree categories. The major changes that occurred in the task inventory fit were caused by shifts that occurred in the important and insignificant ranges. Both the forestry and trucking industries experienced a shift away from the insignificant range towards the important range with the addition of more degrees. With the construction and agricultural industries the influence of the additional degrees had the reverse effect. The automotive industry had no tasks in the important range, therefore its change was caused by shifts between the average and insignificant ranges.

Another way to measure the relationship of additional degrees on the task inventory is to compare the changes in the top ranked tasks. Table 43 lists the top ten ranked tasks for both the "with" and "without" additional degree categories. Note that the list contains 13 items with seven of the top ten tasks being common to both categories. The percentage of change indicates the change in the importance of each task as reported by those "without" additional degrees and those "with" additional degrees. The last three tasks were those that were listed only in the top ten of the "with" additional degrees group. The importance level of nine out of the ten top tasks in the "without" additional degrees category experienced a decline as a result of the additional degrees. This decline was greater than 10% for half of these top tasks. The last three had positive increases and are all automotive related.

Table 43

Comparison of the Changes of Importance in the Top Ten Tasks For the Graduates "With" and "Without" Additional Degrees

Task	Add'l Degrees Avg. Without	Add'l Degrees Avg. With	% Change
Electrical Lighting T-shoot	2.26	2.09	7.5(-)
Elec. Start & Charge T-shoot	2.19	2.06	5.9(-)
Hydraulics T-shoot	1.93	1.56	19.2(-)
Diesel Injection Sys. T-shoot	1.81	1.68	7.2(-)
Electrical Ignition T-shoot	1.76	1.66	5.7(-)
Hydraulic Component Rebuild	1.65	1.32	20.0(-)
Hydraulic Brakes T-shoot	1.58	1.34	15.2(-)
Diesel Engine Overhaul	1.57	1.58	0.6
Air Brakes T-shoot	1.43	1.24	13.3(-)
Rebuild Major Brake Components	1.36	1.22	10.3(-)
Carburetion System T-shoot	1.24	1.38	11.3
Gasoline Engine Overhaul	1.28	1.38	7.8
Elec. Computer Control T-shoot	.84	1.32	57.1

** Research Question #5 **

What recommendations and comments did the Graduates of the Heavy Equipment Program offer?

[Q 5.1] What were the graduates' recommendations on course and curriculum changes?

Appendix XXXVII is a complete alpha listing of all the recommended changes suggested by all the graduates. Appendix XXXVIII is a delimitation of the complete listing by including those recommendations that had a minimum of three frequency responses. Table 44 is a further delimitation by combining those recommended changes which are similar. There were 642 total recommendations made by the graduates. Combining electrical, electronics, and computer controlled systems in Table 44 into one group, accounts for 143 responses or 22.3% of the total. Therefore, better than one out of five graduates believe that the Heavy Equipment Program needs more courses or training in the electrical or electronics area. Second, by combining troubleshooting and diagnostics into one group, 12% of the total responses indicates more training is also needed in this area.

Table 44

Graduates Recommendations on Course and Curriculum Change

Recommendation Area	Frequency of Response	% of Total Recommends
Electrical	46	7.2
Electronics & Electronic Control	69	10.7
Computer Controlled Systems	28	4.4
Troubleshooting	69	10.7
Diagnostics	8	1.2
Air Conditioning	3	5.1
Hydraulics	30	4.7
Courses (Comments)	30	4.7
Fuel Injection Systems	22	3.4
Brakes	20	3.1
Computers (Operations)	17	2.6
Courses (Add)	17	2.6
Curriculum (Change)	17	2.6
Final Drives	15	2.3
Automatic Transmissions	14	2.2
Diesel Engines	13	2.0
Hydrostatics	12	1.9
Powershift Transmissions	10	1.6
Transport Refrigeration	8	1.2

[Q 5.2] What were the most common recommendations or changes suggested by graduates in the various industries?

The complete alpha listing of the recommended changes suggested by all the graduates (Appendix XXXVII) was subdivided into groups by industry. Complete industry changes and recommendations may be found in the following appendices: trucking, Appendix XXXIX; automotive, Appendix XXXX; construction, Appendix XXXXI; and agricultural with forestry in Appendix XXXII. Table 45 is a listing of the top three recommendations for the top four industries.

Table 45

Graduates Most Common Recommendations by Industry

Industry/Courses	Frequency of Response
Trucking	
Troubleshooting	29
Air Conditioning	21
Electrical	17
Automotive	
Electrical	12
Electronics	12
Troubleshooting	11
Construction	
Troubleshooting	15
Hydraulics	9
Powershift Transmissions	9
Agriculture	
Troubleshooting	7
Electrical	5
Hydraulics	5

All four industries list troubleshooting in the top three courses recommended. The second most recommended course was electrical/electronics appearing in 3 out of 4 industries.

[Q 5.3] <u>What were the graduates' general comments?</u>

A complete listing of all the graduates' comments are contained in Appendices XXXXIII, XXXXIV, and XXXXV. These appendices have divided the comments by graduates "without" additional degrees, "with" additional degrees, and the eight discarded surveys, respectively. Each comment contains a code for determining the industry, business and job that the respondent presently holds. The fourth code indicates the type of additional degree the graduate holds. Appendix XXIV is a complete breakdown of these codes. Three important facts surface after reading these comments. First, the graduates are not bashful, they tell it just as it is. Secondly, they are quite thorough and many wrote extensively on the subject. Finally, and definitly important, was that a very high percentage of the comments were positive about the program.

[Q 5.4] <u>Are the graduates interested in updating their skills by taking some type of additional Ferris Training?</u>

Question number 22 on the survey instrument specifically asked this question. Out of the 366 respondents, 219 or 59.6% are interested in further Ferris training. It should also be noted that only 323 or 88.3% of the respondants answered this question. Therefore the 219 positive responses are actually 67.8% of those answering question 22.

SECTION 4

SUMMARY, FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

* Summary *

This study was initiated to establish a basis from which to examine the diversity and changes in the Heavy Equipment Industry for future studies in curriculum development. The approach was to conduct a survey of the graduates of the Heavy Equipment Program at Ferris State University and to document a profile of them and their work places through the answers to the following research questions:

1. What is the work profile of the graduates of the Heavy Equipment Program?

2. What is the profile of the industries for which the graduates of the Heavy Equipment Program presently work?

3. What is the relation of additional degrees to the work profile of the graduates of the Heavy Equipment Program?

4. What is the relation of additional degrees to the industry profile of the Heavy Equipment Graduates?

5. What recommendations and comments did the graduates of the Heavy Equipment Program offer?

Survey questionnaires were sent to 644 Alumni who were graduated in the years 1978 through 1988 from the Heavy Equipment Program. The overall return on the survey was 58%.

* FINDINGS *

1. What is the work profile of the graduates of the Heavy Equipment Program?

The distribution of the respondents by year graduated were quite evenly distributed between the years of 1978 and 1984. Therefore the balance of the questionnaire replies are weighted towards those who have considerable experience in the field. The overall average number of jobs which the graduates have had since graduation is 2.27. The number of graduates who were unemployed at the

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Heavy Equipment Service Engineering Technology

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time of the survey was not obtainable due to confusion created by the question wording on the survey instrument.

A majority of the graduates are working in the area of their training, with 43.2% working as service technicians and 32.2% working in retail distributorships. The type of industry for which they work is primarily split between three: 32% in trucking, 27.6% in automotive, and 19.9% in construction. Only 19, or 5.2% of the Graduates are working in the agricultural industry. Closely related to agriculture is the forestry industry, but only six, or 1.6% of the Graduates work in that industry.

Further refinement of this data was available by performing crosses with the type of job, type of business and type of industry. By crossing the type of jobs with type of business, it was found that 18.6% are working as service technicians in retail distributorships. Also, another 4.9% are working as service technicians in user shops. The business by industry cross yields 13.9% of the graduates working in the automotive manufacturing industry and another 7.9% in the automotive retail business. This is followed by 10.1% who are working in the retail construction and 8.5% in the retail trucking industries.

The jobs by industry cross shows that 21.3% of the graduates are working as service technicians in the trucking industry. The construction industry follows with 10.9% working as service technicians.

Of those graduates who are presently working in the automotive industry, 46.5% changed industries between their first and present jobs. The trucking industry was the lowest with 26.5% changing from another industry. This indicates that the trucking industry is better at holding the graduates in their industry. The construction and agriculture industries fell in the middle with 38.4% and 36.8% respectively.

Many of the Heavy Equipment Graduates have accepted a position with the firm with which they have served an internship. The study shows that 40% of the construction industry, 33% of the automotive industry and 23% of the trucking industry interns accepted a position after graduation with their internship company. This is quite different from the results which were received from the graduates who are teaching. None of them accepted a position with the school or company for which they student taught.

Nearly one eighth of the graduates responding are pursuing further education. Twenty percent of these are pursuing an additional associates, 51.1% are pursuing a bachelors and 28.9% are working towards a masters degree. The most common area of study is that of business, with 48.4% pursuing additional education in that discipline. Engineering ranked second with 17.7%.

It was very interesting to see that graduates are currently employed in 28 of the 5[illegible] states. However, 82.3% of the graduates are presently employed in the State of Michigan!

2. What is the profile of the industries for which the graduates of the Heavy Equipment Program presently work?

A measure of industries interest in a program is its ability to support the program through internships. Again the automotive, trucking and construction industries are the major ones offering internships. The percentage of participation in each industry is by no means equal. Of those students working in the automotive industry, 46.4% have served an internship. This is more than the total of 21.1% in the trucking industry and the 16.3% in the construction industry combined.

A measure of the complexity of an industry, as well as program interest, is to see how many of the graduates are offered some sort of formal trainee training program. In the construction industry, 45.2% of the graduates served in a formal trainee program. The trucking, automotive and forestry industries all ranked very close with one third, or slightly more, of the graduates who worked as a trainee. The average amount of time that the graduates worked as a trainee was from one to six months.

Technological change is the one common thread that spans all industries. An indication of this change is to observe what percentage of the graduates are receiving industry training. Here there is a decisive difference in the percentages for the traditional Heavy Equipment Industries and automotive. In the construction industry, 71.2% of the graduates have received some type of industry training. Trucking and agriculture are also high in the 62% range. The automotive industry is training 39.6% of the graduates working in their industry.

Another area where the Heavy Equipment industry differs with automotive is in the length of time that a graduate must work for a company before attending some type of factory school. The graduate working in the Heavy

Equipment industries must work from seven to twelve months. Those working in the automotive industry attend factory schools after working from one to six months.

How much training is really taking place in the various industries? By dividing the number of courses taken in an industry by the number of graduates working in that industry yields a course to graduate ratio. The automotive industry is training at a level of 1.5 courses per graduate. Second is the trucking industry with 1.26 courses per graduate. The construction and trucking industries are at a level just under one course per graduate.

The types of courses taught by industry are very important as a base for further study for future curriculum development. Nearly one fifth of all the industry courses taught were product related. Although it is not the mission of the Heavy Equipment Program to teach product, the type of product schools offered do give indications of the current equipment trends for each industry. In the technical courses being offered, 18.1% are engine related and another 13.8%, in the same general area, are fuel systems related. One has little trouble in picking out the major problem areas in industry today by observing the technical courses that industry is teaching. In breaking these courses down further, by dividing them into individual industries, interesting patterns appear. Product and diesel engine courses are taught in all the industries except forestry. However, the number of responses of graduates working in the forestry industry were very small and therefore are quite questionable as to the accuracy of any trend developing in that industry. What is apparent is the third, non-common courses that are taught in the four major industries. They are all different and appear to be unique to each industry. These courses are transport refrigeration for trucking, electrical for automotive, hydraulics for construction and drive trains for agriculture.

In addition to the majority of graduates who are working as technicians and in management, some of the graduates are teaching. However, the number is very low with a total of five. Two are teaching automotive classes and the remaining three are teaching classes in the Heavy Equipment field. As for where they are teaching, one is teaching for an automotive manufacturer, two are with career centers and the final two are teaching at a Junior College. The types of courses the Heavy Equipment

Instructors are teaching are very similar to those taught in the current Heavy Equipment Program. The Automotive Instructor working at a career center teaches "the whole car." The Automotive Instructor teaching for a manufacturer teaches many courses which are product oriented.

A list of tasks were given in the survey instrument for the graduates to evaluate. This list is very important for a number of reasons. It gives the planners of the Heavy Equipment Program a guide to compare how well the program fits the needs of each industry. It is through further study of the critical areas that the program fit may be improved. Another benefit is that it will identify those tasks which are the common thread to all of the industries. Once verified, these courses could be used to establish a core in the curriculum. Finally, this list should help to identify those particular tasks which are unique or important to a single industry.

In order to establish the industry fit to the task inventory list, a numerical Likert-type scale from zero to three was established. The area from zero to one was established as the insignificant range, from one to two the average range, and from two to three the important range for evaluating the industry fit. The automotive and others category industries had no tasks that fell in the important range. Consequently their overall average industry fit was very low. The overall average industry fit for the traditional Heavy Equipment Industries fell into the average range, but on the low end of the scale. Further analysis indicates that their fits may be improved by eliminating those tasks which fall into the insignificant range. However, the elimination of these tasks should not even be considered without further study.

The tasks which were the most important had an overall average for all the industries with a rating greater than 2.0. Only two of the tasks were so rated, they were electrical starting and charging troubleshooting and electrical lighting troubleshooting. It is interesting that if one were to list the top ten tasks, seven out of the ten are associated with some type of troubleshooting.

In analyzing the common tasks to all the Heavy Equipment Industries, three were found. They were electrical starting and charging troubleshooting, electrical lighting troubleshooting, and diesel injection troubleshooting. Hydraulics troubleshooting and hydraulics component rebuilding were important to all the Heavy Equipment industries except trucking. Also, electrical ignition systems were important to the forestry and automotive industries.

Three of the tasks were found to be important to only one industry. These were diesel engine overhaul for the automotive industry, hydraulic brakes for the forestry industry and air brakes for the trucking industry.

There were five courses which fell into the insignificant range for all of the industries. Unless further study indicates that they are necessary as a basic fundamental knowledge subject, they should not be a part of the curriculum for the industries evaluated. These courses were: Air conditioning component rebuilding, L.P. gas engine overhaul, diesel injection pump overhaul, diesel injection pump calibration, and hydrostatic transmission rebuilding.

The task inventory list also identified four tasks which were rated insignificant to all the industries except one. These then are those tasks which fit that unique classification. The automotive industry had the distinction of having three of these tasks, which are: electronic fuel injection service, turn brake drums and rotors, and injection system scope analysis. Differential cone point setting was the unique task for the construction industry.

3. What is the relation of additional degrees to the work profile of the graduates of the Heavy Equipment Program?

This survey indicates that 41.8% of the Heavy Equipment Graduates have earned additional degrees. Many have earned an additional associates, a bachelors, a masters degree, or any combination thereof. The most common type of second associates degree earned was in automotive service, with 55.4% of the graduates of this degree level holding this dual degree. The AHM (AHT) Program has attracted 79.3% of the bachelors degreed graduates. One graduate has completed his masters degree in business. In comparing the average number of jobs these graduates have held, those with additional degrees have had 10.6% fewer jobs.

A major shift occurred in the distribution of the graduates type of job as a result of the additional degrees. Such jobs as factory service representatives, middle management, engineering and sales all had over a

100% increase with the additional degrees. Similarly the percentage of graduates who are working in the jobs of service technician, shop foreman, business owner and engineering technicians all experienced declines in the double percentage figures with the additional degrees. The jobs of service manager and parts manager experienced a slight percentage increase with the additional degrees.

The relationship of the additional degrees to the type of business for which the graduates work also shows a significant shift. The number of graduates who are working for manufacturers increased 224% over those without additional degrees. The number of graduates working for independent repair shops, rental leasing companies, municipalities, specialty shops, and user shops all decreased in the range of 77% to 57% with additional degrees.

The number of the graduates working for the automotive industry increased 214% with the completion of additional degrees. The number of graduates working in the agricultural, trucking, and construction industries all decreased in the double percentage figures when additional degrees were taken.

The relationship of the type of job held by the type of additional degree held gives further insight into the trends that additional degrees create. Nearly 43% of the graduates earning a second associates degree continue to work as service technicians. A majority of those earned their second degree in auto service. Of those graduates earning a bachelors degree, 23.4%, are working as factory service representatives. A large percentage of these, 84.6%, have earned their degrees in Automotive Heavy Equipment Management (AHM/AHT).

The final comparison is with the additional degrees and the type of industry for which the graduates work. For those graduates who have earned a second associates degree, 34% are working in the automotive industry, 27% are working in the trucking industry and 20% are working in the construction industry. For those graduates who have received a bachelors degree, 53.2% are working in the automotive industry. Both the trucking and construction industries combined attract less than 30% of the graduates.

Internships are a very important part of many degrees. They give both the student and the internship company an opportunity to look at each other before actual hiring occurs. Obviously the internship company is in a great position to influence the student on making a career choice. This influence can be measured by what percentage of the graduates accept a position with the firm with which they interned. In comparing other additional degrees with those who have completed the AHM/AHT Program, the difference in the percentages of those accepting positions is quite remarkable. For those with the AHM/AHT Degree, 42.5% accepted a position with the firm with which the graduate interned. Only 7% of those graduates with the other types of degrees accepted such a position.

4. <u>What is the relation of additional degrees to the work profile of the graduates of the Heavy Equipment Program?</u>

The length of time that a graduate worked as a trainee decreased with the addition of more degrees. The 12% decrease in the automotive industry was not as severe as the 42% decrease in the construction industry. The trucking industry decreased 23%.

The change in the length of time that the graduates worked before attending a factory school was not consistent in all industries. When the graduates received additional degrees, the length of time they worked before attending a factory school increased by 7% in the automotive industry. The change in the construction and trucking industries was just the opposite, both experienced a decrease in the time period.

What was the relationship of additional degrees on the type of factory schools attended? Overall the largest change occurred with an increase in courses that pertained to management. There were a few increases in the technical schools attended, but on the whole, factory training on technical courses, particularly those subject areas covered in the Heavy Equipment Industry, decreased with when the graduate received additional degrees.

The fit of an industry to the task inventory list did change with the addition of more degrees. It improved slightly for the forestry, trucking and automotive industries. However, the fit was much worse for the construction and agriculture industries. The reasons for these changes can best be seen by looking at the shifts that occurred in the various ranges that the tasks fell into. The improved fit for the forestry and trucking industries occurred because there were fewer of the insignificant and more of the important tasks with the graduates that have additional degrees. The reverse was true for the construction and agriculture industries. The automotive industry did not have any tasks that fell into the important range, therefore, its improved fit with additional degrees occurred by the decrease of the insignificant tasks and an increase in the average tasks.

In comparing the top ten ranked tasks for both those graduates with additional degrees and those without, most of the average values of the tasks were adversly effected by the additional degrees. There were only three that were not, and they were all tasks that are typically used in the automotive industry.

5. <u>What recommendations and comments did the graduates of the Heavy Equipment Program offer?</u>

The graduates expressed a strong desire to see more instruction in the electrical, electronic or computer controlled systems area. In fact, 22.3% of the recommendations were in that general area. The second area of concern was that of diagnostics or troubleshooting. Twelve percent of the recommendations requested more troubleshooting.

These same type of recommendations surfaced when they were separated out by the various industries for which the graduates work. More troubleshooting ranked within the top three recommendations for the trucking, automotive, construction and agricultural industries. Recommendations for electrical/electronics were common in three of the four industries.

A complete set of graduate comments are included in appendices XXXXIII, XXXXIV and XXXXV. It is strongly recommended that the reader look at these comments, which are very open and quite positive.

How many of the graduates are interested in updating their knowledge base? Not all of the graduates answered this question. However, 59.8% of the graduates indicated that they were interested in some type of Ferris updating. This was actually 67.8% of the graduates who answered the updating question.

* Conclusions *

This study provides the necessary information for establishing a solid base on which to build a Heavy Equipment Curriculum that is even stronger than the present program. Many questions have been answered, some of which have lingered for years in the minds of some of the faculty. Also, just as many or more new questions have been created for further study. Further analysis should put the curriculum in a much better position for satisfying industries' needs.

1. The number of responses received from the graduates who are working in the automotive, trucking and construction industries were adequate for establishing the trends for future studies for curriculum development. However, the responses for the agricultural and forestry industries were very low and should be used accordingly in trying to establish any major trends. The same conditions also apply to those who are seeking trends for the teacher education program.

2. The study further indicates that there is plenty of room for improvement in matching industry needs to the task inventory list. Some of the tasks were very important while others should be reviewed further to establish their purpose and need. The list was not all inclusive, but it certainly established a starting point.

3. Industry training and graduate recommendations indicate a solid technical base is very important. Electrical, electronic or computer controlled systems seems to be the technical area of the most concern. There were also many requests for advanced troubleshooting in all the technical areas. Therefore, the overall need seems to be directed toward more advanced technical courses.

4. Some of the students have indicated a desire for some type of internship in the technical program. The success and effectiveness of internships in the AHM(AHT) Program indicates that this could be a very effective tool in marketing the technical program.

5. There are a number of students who are employed in the engineering or engineering related field.

6. Of continued concern is the number of students who are lost to the automotive industry. The study substantiates the number and the task inventory also indicates that they are not as well prepared as they would be for positions in the Heavy Equipment Industry.

7. The courses that are taught in the Heavy Equipment Program differ from those taught in auto service. This difference is verified in the task inventory, industry taught courses and by the graduates' comments. In spite of these differences, the Heavy Equipment Graduates continue to do well in the automotive industry. This certainly speaks highly of the graduates of the program.

* Recommendations *

1. The responses to this survey from the agricultural and forestry industries were very sparse. Further investigation into these areas must be conducted. If the jobs are there, then there is a need to establish a marketing plan to better serve those industries.

2. Very few of the graduates who have earned a degree in teaching are teaching in the Heavy Equipment Industry. Most are working outside the teaching field or teaching automotive. Further investigation should be made into the need for Heavy Equipment instructors. If the market is not going to improve, the students should be advised not to pursue this bachelors degree option.

3. The combination of the task inventory results, courses offered by industry, graduates' recommendations and comments all indicate a very strong need to look very closely at furthering electrical/electronic education and to pursue some type of troubleshooting program(s). Further studies must be conducted to confirm the need and course content of these important areas.

4. There are a reasonable number of graduates who are currently working in the engineering/engineering technician fields. These fields should be studied very closely to determine what courses could be added to the curriculum to make this a possible attractive option for the Heavy Equipment student.

5. Of great concern are the number of graduates of the Heavy Equipment Program who are lost to the automotive industry. Without a doubt, a very strong factor effecting this migration is the AHM (AHT) Program. With the high percentage of the AHM graduates accepting positions with the firms with which they intern, an attempt must be made to include more internships in the Heavy Equipment Industry. In addition, the AHM Program needs to establish a marketing plan to better inform the manufacturing and retail distributor segments of the Heavy Equipment Industry of the merits of their program. As the graduates have commented, the AHM Program is not widely accepted in the Heavy Equipment Industry!

6. Another concern is the advanced level of technical courses which the industries and graduates both

indicate is needed. Careful analysis of the tasks and the industry fits to the current task inventory list indicates how sensitive each task is to the overall industry fit. As courses become more advanced technically, they tend to meet more specific needs of a particular industry. Therefore, when further study is pursued for possible curriculum or course content changes, the delicate balance of the tasks must be protected for each industry. Any attempts to combine industries into common tasks for the sake of departmental convenience, or on the basis of just being similar must be avoided! Those involved in the current study of an Automotive Heavy Equipment technical option bachelors degree must be aware of the pitfalls with common courses at a highly technical level. The establishment of a program using common courses to satisfy uncommon needs will be detrimental to the effectiveness of the program meeting either of the programs needs!

APPENDICES

Identification number

FERRIS STATE UNIVERSITY

HEAVY EQUIPMENT SERVICE ALUMNI SURVEY

General Directions: Please complete ALL responses that apply by filling in the blank or placing an "x" in the appropriate box. Your frank response is very important for the improvement and continued success of the Heavy Equipment Service Program.

All responses to this survey will be kept strictly confidential.

SECTION 1 - GENERAL INFORMATION

1. What year did you graduate from the Heavy Equipment Service Program?

   19__ __

2. How many different employers have you worked for since graduation?

   ☐ 1-one
   ☐ 2-two
   ☐ 3-three
   ☐ 4-four
   ☐ 5-five or more

3. Are you presently unemployed ?

   ☐ 1-yes ☐ 2-no

(If yes, please complete this survey as if you were still employed by your last employer.)

4. What is your present job title or classification ? (CHECK ONE)

   ☐ 1-Service technician (mechanic)
   ☐ 2-Shop foreman
   ☐ 3-Service manager
   ☐ 4-Factory service representative
   ☐ 5-Middle management
   ☐ 6-Top management (but not business owner)
   ☐ 7-Business owner
   ☐ 8-Instructor (teacher)
   ☐ 9-Other ____________________ (please specify)

5. What is the nature of your present employers (or your) business? (CHECK ONE)

   ☐ 1-Retail distributor (Dealership)
   ☐ 2-Manufacturer
   ☐ 3-Educational institution
   ☐ 4-Specialty shop (ie. injection pump rebuild or electrical component rebuild etc.)
   ☐ 5-Other ____________________ (please specify)

6. What type of industry does your present employer (or your) business serve? (If more than one industry is served, please check only the one with which you do the most business.)

   ☐ 1-Agriculture
   ☐ 2-Automotive
   ☐ 3-Construction
   ☐ 4-Forestry
   ☐ 5-Trucking
   ☐ 6-Generator sets (stand by power)
   ☐ 7-Marine
   ☐ 8-Refrigeration
   ☐ 9-Other ____________________ (Please specify)

7. If teaching is your primary job, please check the type of institution (employer) for which you teach. (If teaching is not your primary job, leave questions 7 & 8 blank)

- ☐ 1-Retail distributor (dealership)
- ☐ 2-High school
- ☐ 3-Career center
- ☐ 4-Community or junior college
- ☐ 5-Private school
- ☐ 6-Four year college or university
- ☐ 7-Manufacturer
- ☐ 8-Other ______________ (please specify)

8. If teaching is your primary job, please list the courses that you most often teach.

SECTION 2 - FIRST JOB INFORMATION

9. What was the nature of your FIRST employer's business after graduation? (CHECK ONE)

- ☐ 1-Retail distributor (dealership)
- ☐ 2-Manufacturer
- ☐ 3-Educational institution
- ☐ 4-Specialty shop (ie. injection pump rebuild or electrical component rebuild etc.)
- ☐ 5-Other ______________ (please specify)

10. What type of industry did your FIRST employer after graduation serve? (If more than one industry was served, please check only the one with which the most business was done.)

- ☐ 1-Agriculture
- ☐ 2-Automotive
- ☐ 3-Construction
- ☐ 4-Forestry
- ☐ 5-Trucking
- ☐ 6-Generator sets (stand by power)
- ☐ 7-Marine
- ☐ 8-Refrigeration
- ☐ 9-Other ______________ (Please specify)

11. On your FIRST job, did you serve a specific time period as a trainee?

☐ 1-yes ☐ 2-no

12. If yes, how many months did you serve as a trainee?

- ☐ 1-Less than one month
- ☐ 2-One to six months
- ☐ 3-Seven to twelve months
- ☐ 4-More than twelve months

13. On your FIRST job, how many months did you work before attending some type of factory school?

- ☐ 1-Less than one month
- ☐ 2-One to six months
- ☐ 3-Seven to twelve months
- ☐ 4-Thirteen to eighteen months
- ☐ 5-Nineteen to twenty four months
- ☐ 6-More than twenty four months

SECTION 3-EDUCATION

14. Please list below ALL factory schools that you attended during your first two years of employment after graduation.

Subject or
Course Name

15. Have you received any degrees in addition to your Heavy Equipment Service degree?

☐ 1-yes ☐ 2-no

16. If yes, please enter the following codes for each type of degree completed beyond your heavy equipment degree.

01 Auto Service
02 Auto Machine
03 AHM (AHT)
04 Trade Technical Teaching
05 Business
06 Engineering
07 Other (please specify)

EXAMPLE: Associates __01__ __02__ _____
This example would indicate that you have an associates in auto service and auto machine in addition to your associate in H.E.S.

1-Associates _____ _____ _____
2-B.S. _____ _____ _____
3-M.S. _____ _____ _____
4-PHD _____ _____ _____
5-Other _____ _____ _____
(please specify)

17. If any of the additional degrees that you received contained an internship or student teaching, after graduation did you accept a job with the firm or school which you interned or student taught?

☐ 1-yes ☐ 2-no

18. Are you presently working on another degree?

☐ 1-yes ☐ 2-no

19. If yes, please use the codes from question number 16 to indicate the type of degree you are pursuing.

1-Associates__________ 4-PHD__________
2-B.S.__________ 5-Other__________
3.M.S.__________ (please specify)

SECTION 4-TASK INVENTORY

20. Listed below are several tasks that may be encountered in the Heavy Equipment field. Please rate each task by circling the number that indicates how often you encounter it on your PRESENT job.

	Very Often	Some-time	Seldom	Never
1. Air brakes troubleshooting	4	3	2	1
2. Hydraulic brakes troubleshooting	4	3	2	1
3. Rebuild of major brake components	4	3	2	1
4. Turn brake drums or rotors	4	3	2	1
5. Air conditioning system troubleshooting	4	3	2	1
6. Air conditioning component rebuilding	4	3	2	1
7. Diesel engine overhaul	4	3	2	1
8. Gasoline engine overhaul	4	3	2	1
9. L.P. gas engine overhaul	4	3	2	1
10. Differential cone point setting	4	3	2	1
11. Rebuild planetary sets or hubs	4	3	2	1
12. Carburetion system troubleshooting	4	3	2	1
13. Carburetor overhaul	4	3	2	1
14. Diesel injection system troubleshooting	4	3	2	1
15. Diesel injector cleaning and setting	4	3	2	1
16. Diesel injection pump overhaul	4	3	2	1
17. Diesel injection pump calibration	4	3	2	1
18.Electronic fuel injection systems servicing	4	3	2	1
19. Electrical lighting systems troubleshooting	4	3	2	1
20. Electrical troubleshooting starting & charging systems	4	3	2	1
21.Electrical troubleshooting ignition systems	4	3	2	1
22. Electrical troubleshooting computer control systems	4	3	2	1
23 Generator or alternator rebuilding	4	3	2	1
24. Starter rebuilding	4	3	2	1
25.Electronic ignition systems	4	3	2	1
26.Ignition system scope analysis	4	3	2	1
27. Hydraulics troubleshooting	4	3	2	1
28. Hydraulics component rebuilding	4	3	2	1
29. Manual transmission rebuilding	4	3	2	1
30. Automatic/powershift trans. troubleshooting	4	3	2	1
31. Automatic/powershift trans. rebuilding	4	3	2	1
32. Hydrostatic transmission troubleshooting	4	3	2	1
33. Hydrostatic transmission rebuilding	4	3	2	1
34. Suspension system alignment	4	3	2	1
35. Suspension system rebuilding	4	3	2	1
36. Front axel rebuilding	4	3	2	1
36. Pin and bush track systems	4	3	2	1

SECTION 5 - COMMENTS

21. In order to assist the program planners of the Heavy Equipment curriculum in their future planning, please list any courses that you feel are important to your present job that should be considered for inclusion in the curriculum. The courses may be current needs or new technologies that you foresee affecting your job in the future. Please feel free to also comment on the present curriculum course concentration levels.

22. If Ferris could provide courses for updating your skills and knowledge, would you be interested in taking these courses?

☐ 1-yes ☐ 2-no

23. Please give us the city and state in which you work.

city________________

state________________

zip________________

24. Additional comments and/or suggestions:

THANK YOU VERY MUCH FOR YOUR HELP IN MAKING THE HEAVY EQUIPMENT PROGRAM A CONTINUED SUCCESS!

Please place the completed survey in the enclosed prepaid envelope and return it to:
Ferris State University
School of Technology
Auto/Heavy Equipment Dept. (HEC-203)
Big Rapids, Mi. 49307-9989

Ferris State University
Automotive & Heavy Equipment

September 14, 1988

Dear Heavy Equipment Alumnus,

THE HEAVY EQUIPMENT SERVICE PROGRAM AT FERRIS STATE UNIVERSITY NEEDS YOUR HELP!

As you know technology is advancing at a very rapid rate in the heavy equipment industry. As a result of this fact, the faculty and administration are looking at many different options for improvements in the heavy equipment curriculum. Many of you have heard me say over the years, "Our Alumni are the eyes and ears of our program." So please, let us hear from you by filling out the enclosed questionaire and returning it to me as soon as possible. Your prompt return will avoid the expense of us having to send an additional follow-up survey and letter to you.

Thank you very much for taking an active part in your heavy equipment program.

Sincerely yours,

Kenny R. Acton
Assistant Professor

KRA:dl

ENCLOSURE

School of Technology • Big Rapids, Michigan 49307 • (616) 592-5981

APPENDIX III

NO POSTAGE
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UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 8 BIG RAPIDS, MI 49307-2295

POSTAGE WILL BE PAID BY ADDRESSEE

FERRIS STATE UNIVERSITY
School of Technology {2-39180}
Auto/Heavy Equipment Dept. {HEC-203}
BIG RAPIDS, MI 49307-9989

Ferris State College

Automotive & Heavy Equipment Department

November 1988

Dear Heavy Equipment Alumnus,

The Heavy Equipment Service Program at Ferris State University has three major objectives:

1. To teach its students current technology.
2. To provide industry with a quality employee.
3. To maintain program integrity which attracts new enrollment and promotes pride and support for all its graduates.

Some time ago we requested your assistance in filling out and returning a Heavy Equipment Service Alumni Survey. As of this date we have not received your response. **WE NEED YOUR HELP!** We cannot fulfill our objectives, without your input.

PLEASE; sit down this evening, fill out and return the enclosed questionnaire?

Sincerely yours,

Kenny R. Acton

Kenny R. Acton
Assistant Professor

KRA:dl

Enclosure

School of Technology • Big Rapids, Michigan 49307 • (616) 796-0461, Ext. 5370

APPENDIX V

DISTRIBUTION OF GRADUATES BY YEAR GRADUATED

Year	Total Graduates		WITHOUT Add'l Degrees		WITH Add'l Degrees	
	Number	% of Total	Number	% of Year	Number	% of Year
1974	1	0.3	1	100	--	--
1975	1	0.3	1	100	--	--
1976	1	0.3	--	--	1	100
1977	5	1.4	3	60.0	2	40.0
1978	33	9.0	22	66.7	11	33.3
1979	35	9.5	23	65.7	12	34.3
1980	42	11.5	21	50.0	21	50.0
1981	54	14.8	24	44.4	30	55.6
1982	37	10.1	16	43.2	21	56.8
1983	35	9.5	21	60.0	14	40.0
1984	37	10.0	24	64.9	13	35.1
1985	30	8.2	18	60.0	12	40.0
1986	21	5.7	10	47.6	11	52.4
1987	20	5.5	17	85.0	3	15.0
1988	14	3.8	12	85.7	2	14.3
Totals	366		213		153	

APPENDIX VI

NUMBER OF JOBS SINCE GRADUATION

	Totals		WITHOUT Add'l Degrees						WITH Add'l Degrees					
	No.	Yearly	No. of jobs						No. of Jobs					
Year	Grads	Average	1	2	3	4	5	Avg.	1	2	3	4	5	Avg.
1974	1	3.00	-	-	1	-	-	3.00	-	-	-	-	-	--
1975	1	2.00	-	1	-	-	-	2.00	-	-	-	-	-	--
1976	1	2.00	-	-	-	-	-	--	-	1	-	-	-	2.00
1977	5	1.92	-	2	1	-	-	2.33	1	1	-	-	-	1.50
1978	33	3.05	4	3	6	3	6	3.18	2	2	4	1	2	2.91
1979	35	2.62	4	7	8	1	3	2.65	2	6	1	1	2	2.58
1980	42	2.58	8	3	5	2	3	2.48	5	6	5	1	4	2.67
1981	54	2.86	2	5	11	2	4	3.04	6	8	8	6	2	2.67
1982	37	2.72	1	6	4	1	4	3.06	5	9	3	2	2	2.38
1983	35	2.87	2	3	9	5	2	3.10	4	2	5	2	1	2.57
1984	37	2.14	9	9	5	-	1	1.96	2	7	2	2	-	2.31
1985	30	2.10	4	7	5	2	-	2.28	4	5	3	-	-	1.92
1986	21	1.53	6	2	2	-	-	1.60	7	3	1	-	-	1.45
1987	20	1.43	12	4	-	-	1	1.18	1	2	-	-	-	1.67
1988	14	1.17	8	4	-	-	-	1.33	2	-	-	-	-	1.00
Overall Averages		2.27						2.37						2.13

APPENDIX VII

TYPE OF JOB PRESENTLY HELD

	TOTALS		WITHOUT Add'l Degrees		WITH Add'l Degrees	
Job	No.	% of Total	No.	% of Job	No.	% of Job
Service Technician	158	43.2	125	79.1	33	20.9
Factory Serv Rep	30	8.2	2	6.7	28	93.3
Shop Foreman	26	7.1	17	65.4	9	34.6
Middle Management	26	7.1	10	38.5	16	61.5
Service Manager	21	4.7	12	57.1	9	42.9
Business Owner	20	5.5	12	60.0	8	40.0
Engineering Tech	11	3.0	7	63.6	4	36.4
Engineer	9	2.4	2	22.2	7	77.8
Sales	8	2.2	2	25.0	6	75.0
Parts Manager	7	1.9	4	57.1	3	42.9
Top Management	6	1.6	2	33.3	4	66.7
Driver/Equip operator	6	1.6	4	66.7	2	33.3
Instructor	5	1.4	-	0	5	100.0
Service Advisor	5	1.4	-	0	5	100.0
Plant Maint./Millwright	3	0.8	2	66.7	1	33.3
Factory Work-General	2	0.5	2	100.0	-	0
Pilot	2	0.5	-	0	2	100.0
Warranty	2	0.5	-	0	2	100.0
Farmer	2	0.0	2	100.0	-	0
Other	2	0.5	-	0	2	100.0
Claims Representative	1	0.3	-	0	1	100.0
Mechanic Cert. Analyst	1	0.3	-	0	1	100.0
Satellite Technician	1	0.3	1	100.0	-	0
Electronics Technician	1	0.3	-	0	1	100.0
Microwave System Tech.	1	0.3	1	100.0	-	0
Radar Technician	1	0.3	1	100.0	-	0
Fiscal Analyst	1	0.3	-	0	1	100.0
Construction Estimator	1	0.3	1	100.0	-	0
Bus Safety Inspector	1	0.3	-	0	1	100.0
Die Polisher	1	0.3	-	0	1	100.0
Die Maker	1	0.3	-	0	1	100.0
Student	1	0.3	1	100.0	-	0
Derrick Hand	1	0.3	1	100.0	-	0
Press Helper	1	0.3	1	100.0	-	0
Mining Technician	1	0.3	1	100.0	-	0
Totals	366		213		153	

APPENDIX VIII

Type of Business of Present Employer

Business	TOTALS No.	TOTALS % of Total	WITHOUT Add'l Degrees No.	WITHOUT Add'l Degrees % of Business	WITH Add'l Degrees No.	WITH Add'l Degrees % of Business
Retail Distributor	118	32.2	76	64.4	42	35.6
Manufacturer	80	21.9	24	30.0	56	70.0
User Shop	30	8.2	23	76.7	7	23.3
Trucking	18	4.9	13	72.2	5	27.8
Rental Leasing	16	4.4	13	81.3	3	18.7
Indep. Repair Shop	14	3.8	12	85.7	2	14.3
Municipality	10	2.7	8	80.0	2	20.0
Specialty Shop	9	2.4	7	77.8	2	22.2
Contractor	9	2.4	5	56.6	4	44.4
Busses	8	2.2	5	62.5	3	37.5
Fleet Operation	8	2.2	6	75.0	2	25.0
Military	8	2.2	4	50.0	4	50.0
Educational Inst.	7	1.9	2	28.6	5	71.4
Utilities	4	1.1	3	75.0	1	25.0
Moving & Rigging	3	0.8	3	100.0	-	0
Parts/Service Sales	3	0.8	2	66.7	1	33.3
State of Michigan	2	0.5	-	0	2	100.0
Oil and Gas	2	0.5	1	50.0	1	50.0
Consultant	2	0.5	-	0	2	100.0
Aerospace	2	0.5	-	0	2	100.0
Recreation Facility	2	0.5	2	100.0	-	0
Package Deliv. Srv.	1	0.3	-	0	1	100.0
Print Shop	1	0.3	1	100.0	-	0
Ind. Pump Supplier	1	0.3	1	100.0	-	0
Advertising Agency	1	0.3	-	0	1	100.0
Tech. Pub. (Training)	1	0.3	-	0	1	100.0
Tool & Die	1	0.3	-	0	1	100.0
Telephone (Long Dis.)	1	0.3	1	100.0	-	0
Railroad	1	0.3	-	0	1	100.0
Coal Mining	1	0.3	1	100.0	-	0
Insurance	1	0.3	-	0	1	100.0
Wholesale Nursery	1	0.3	-	0	1	100.0
Totals	366		213		153	

APPENDIX IX

Type of Industry Present Employer Serves

	TOTALS		WITHOUT Add'l Degrees		WITH Add'l Degrees	
Industry	No.	% of Industry	No.	% of Industry	No.	% of Industry
Trucking	117	32.0	84	71.8	33	28.2
Automotive	101	27.6	31	30.7	70	69.3
Construction	73	19.9	49	67.1	24	32.9
Agricultural	19	5.2	16	84.2	3	15.8
Other	9	2.4	6	66.7	3	33.3
Military	8	2.2	3	37.5	5	62.5
Maint. (Plant)	8	2.2	5	62.5	3	37.5
Forestry	6	1.6	4	66.7	2	33.3
Oil and Gas	5	1.4	2	40.0	3	60.0
Engines	3	0.8	2	66.7	1	33.3
Forklifts	3	0.8	2	66.7	1	33.3
Marine	3	0.8	2	66.7	1	33.3
Golf & Turf Dist.	2	0.5	2	100.0	-	0
Generator Sets	1	0.3	1	100.0	-	0
Railroad	1	0.3	-	0	1	100.0
Communications	1	0.3	1	100.0	-	0
Power Plant	1	0.3	-	0	1	100.0
Defence	1	0.3	-	0	1	100.0
Lawn & Garden	1	0.3	-	0	1	100.0
City Water Supply	1	0.3	1	100.0	-	0
Woodworking Plant	1	0.3	1	100.0	-	0
Skiing Resort	1	0.3	1	100.0	-	0
Totals	366		213		153	

APPENDIX X

DISTRIBUTION OF PRESENT JOBS HELD BY TYPE BUSINESS (ALL)

	Type of Business													
Job	A	B	C	D	E	F	G	H	I	J	K	L	M	Totals
Service Tech.	68	11	18	12	11	6	9	5		6	4	3		153
Business Owner		3				8			23					34
Fact. Serv. Rep.		29												29
Service Manager	15	8												23
Shop Foreman	7		5	3	3						4			22
Engineering Tech.		10												10
Middle Management	7													7
Engineer		7												7
Sales	6													6
Parts Manager	5													5
Instructor													4	4
Service Advisor	4													4
Totals	112	68	23	15	14	14	9	5	23	6	8	3	4	304

Business Identifications

A - Retail Distributor
B - Manufacturer
C - User Shop
D - Trucking
E - Rental Leasing
F - Independent Repair Shop
G - Municipality
H - Specialty Shop
I - Contractor
J - Busses
K - Fleet Operation
L - Military
M - Educational Institution

*This table contains data with frequencies of three or more respondents per category.

APPENDIX XI

DISTRIBUTION OF BUSINESSES BY TYPE INDUSTRY (ALL)

	Type of Industry									
Business	A	B	C	D	E	F	G	H	I	Totals
Retail Distributor	31	29	37	10			3		3	113
Manufacturer	5	51	10	3	5					74
User Shop	12		8	4			3	3		30
Trucking	18									18
Rental Leasing	14									14
Indep. Repair Shop	6	4								10
Municipality	5		3							8
Specialty Shop	5	3								8
Contractor			8							8
Busses	8									8
Fleet Operation	6									6
Military						7				7
Educational Inst.	3									3
Totals	113	87	66	17	5	7	6	3	3	307

Industry Identification

A - Trucking
B - Automotive
C - Construction
D - Agriculture
E - Other
F - Military
G - Forestry
H - Oil and Gas
I - Forklifts

APPENDIX XII

DISTRIBUTION OF PRESENT JOB HELD BY TYPE INDUSTRY (ALL)

Job	Type of Industry A	B	C	D	E	F	Totals
Service Technician	78	16	40	8	4	3	149
Factory Service Rep.		23	3				26
Shop Foreman	12	3	5				20
Middle Management	3	11	6				20
Service Manager	5	6	3	4			18
Business Owner	5	6	6				17
Engineering Technician		10					10
Sales	3	4					7
Service Advisor		5					5
Driver/Equipment operator			3				3
Instructor	3						3
Top Management				3			3
Totals	109	84	66	15	4	3	281

Industry Identification

A - Trucking
B - Automotive
C - Construction
D - Agruculture
E - Maintenance (Plant)
F - Forestry

*This table contains data with frequencies of three or more respondents per category.

APPENDIX XIII

INDUSTRY CHANGES FROM FIRST TO PRESENT JOB

	TOTALS			WITHOUT Add'l Degrees			WITH Add'l Degrees		
PRESENT INDUSTRY	Total No.	No. Chg.	% Chg.	Total No.	No. Chg.	% Chg.	Total No.	No. Chg.	% Chg.
Trucking	117	31	26.5	84	22	26.2	33	9	27.3
Automotive	101	47	46.5	31	17	54.8	70	30	42.9
Construction	73	28	38.4	49	16	32.7	24	12	50.0
Agricultural	19	7	36.8	16	6	37.5	3	1	33.3
Other	9	9	100.0	6	6	100.0	3	3	100.0
Military	8	5	62.5	3	3	100.0	5	2	40.0
Maint. (Plant)	8	8	100.0	5	5	100.0	3	3	100.0
Forestry	6	6	100.0	4	4	100.0	2	2	100.0
Oil and Gas	5	1	20.0	2	1	50.0	3	0	--
Engines	3	3	100.0	2	2	100.0	1	1	100.0
Forklifts	3	3	100.0	2	2	100.0	1	1	100.0
Marine	3	2	66.7	2	1	50.0	1	1	100.0

*This table contains data with frequencies of three or more respondents in the total category.

APPENDIX XIV

GRADUATES WHO ACCEPTED A POSITION WITH INTERNSHIP COMPANY

	Grads With Internships			AHM Grads		
Industry	Total No.	Accepted Position	% Accepted	Total No.	Accepted Position	% Accepted
Agriculture	2	1	50.0	1	1	100.0
Automotive	57	19	33.3	45*	18	40.0
Construction	20	8	40.0	10	6	60.0
Forestry	2	0	--	1	0	--
Trucking	26	6	23.1	14	6	42.9
Marine	1	0	--	--	--	--
Other	15	3	20.0	9	3	33.3
Totals	123	37	30.1%	80*	34	42.5%

*The total number of AHM graduates who responded to this survey was 88. The eight who failed to respond to this question are all employed in the automotive industry.

APPENDIX XV

TYPES OF ADDITIONAL DEGREES GRADUATES ARE PURSUING

Degree Level	Degree Type	Number	% of Total
Associates			
	Other	3	6.7
	Auto Service	2	4.4
	Business	2	4.4
	Engineering	2	4.4
	Totals	9	20.0
Bachelors			
	Business	11	24.4
	Engineering	5	11.1
	AHM	3	6.7
	Teaching	3	6.7
	Other	1	2.2
	Totals	23	51.1
Masters			
	Business	9	20.0
	Other	2	4.4
	Engineering	1	2.2
	Teaching	1	2.2
	Totals	13	28.9

APPENDIX XVI

GEOGRAPHIC LOCATION OF GRADUATES PRESENT JOB

State	Number	% of Total
Michigan	297	82.3
Indiana	8	2.2
California	5	1.4
Florida	5	1.4
Ohio	5	1.4
Wisconsin	5	1.4
Colorado	4	1.1
Texas	4	1.1
Connecticut	2	0.5
Georgia	2	0.5
Illinois	2	0.5
Louisiana	2	0.5
Massachusetts	2	0.5
No. Carolina	2	0.5
New Jersey	2	0.5
Rhode Island	2	0.5
Alaska	1	0.3
Kentuchy	1	0.3
Maine	1	0.3
Maryland	1	0.3
Minnesota	1	0.3
Mississippi	1	0.3
Missouri	1	0.3
New York	1	0.3
Pennsylvania	1	0.3
So. Carolina	1	0.3
Vermont	1	0.3
Washington	1	0.3
Total	*361	100%

*Five graduates did not respond to this question.

APPENDIX XVII

PERCENTAGE OF GRADUATES IN TRAINEE PROGRAM

TOTALS (ALL GRADS)

Industry	No. Grads in Industry	No. of Grad Trainees	% of Industry having Trainees
Trucking	117	43	36.8
Automotive	101	37	36.6
Construction	73	33	45.2
Agriculture	19	3	15.8
Forestry	6	2	33.3
Totals	316	118	37.3

WITHOUT ADDITIONAL DEGREES

Industry	No. Grads in Industry	No. of Grad Trainees	% of Industry having Trainees
Trucking	84	29	34.5
Automotive	31	11	35.5
Construction	49	22	44.9
Agriculture	16	3	18.8
Forestry	4	1	25.9
Totals	184	66	35.9

WITH ADDITIONAL DEGREES

Industry	No. Grads in Industry	No. of Grad Trainees	% of Industry having Trainees
Trucking	33	14	42.4
Automotive	70	26	37.1
Construction	24	11	45.8
Agriculture	3	0	-
Forestry	2	1	50.0
Totals	132	52	39.4

APPENDIX XVIII

TIME GRADUATES WORKED AS TRAINEE BY INDUSTRY

TOTAL (ALL GRADS)

Industry	Time (Months) <1	1-6	7-12	>12	Weighted Averages
Trucking	13	23	2	5	1.98
Automotive	8	18	5	6	2.24
Construction	9	13	3	8	2.30
Agricultural	1	-	-	2	3.00
Forestry	1	1	-	-	1.50

WITHOUT ADDITIONAL DEGREES

Industry	Time (Months) <1	1-6	7-12	>12	Weighted Average
Trucking	8	14	2	5	2.14
Automotive	3	3	2	3	2.45
Construction	2	10	3	7	2.68
Agricultural	1	-	-	2	3.00
Forestry	1	-	-	-	1.00

WITH ADDITIONAL DEGREES

Industry	Time (Months) <1	1-6	7-12	>12	Weighted Average
Trucking	5	9	-	-	1.64
Automotive	5	15	3	3	2.15
Construction	7	3	-	1	1.55
Agricultural	-	-	-	-	--
Forestry	-	1	-	-	2.00

APPENDIX XIX

PERCENTAGE OF GRADUATES RECEIVING INDUSTRY TRAINING

TOTALS (ALL GRADS)

Industry	No. Grads in Industry	No. Grads With Ind. Training	% Grads Ind. Training
Trucking	117	73	62.4
Automotive	101	40	39.6
Construction	73	52	71.2
Agricultural	19	12	63.2
Forestry	6	3	50.0

WITHOUT ADDITIONAL DEGREES

Industry	No. Grads in Industry	No. Grads With Ind. Training	% Grads Ind. Training
Trucking	84	52	61.9
Automotive	31	16	51.6
Construction	49	33	67.3
Agricultural	16	10	62.5
Forestry	4	2	50.0

WITH ADDITIONAL DEGREES

Industry	No. Grads in Industry	No. Grads With Ind. Training	% Grads Ind. Training
Trucking	33	21	63.6
Automotive	70	44	62.9
Construction	24	19	79.2
Agricultural	3	2	66.7
Forestry	2	1	50.0

APPENDIX XX

TIME GRADUATES WORKED BEFORE ATTENDING INDUSTRY SCHOOLS

TOTAL (ALL GRADS)

Industry	Time (Months) <1	1-6	7-12	13-18	19-24	>24	Weighted Average
Trucking	7	16	18	6	7	19	3.64
Automotive	12	23	13	3	1	8	2.70
Construction	7	10	15	4	2	14	3.50
Agriculture	3	1	4	1	1	2	3.17
Forestry	-	-	1	-	-	2	5.00

WITHOUT ADDITIONAL DEGREES

Industry	Time (Months) <1	1-6	7-12	13-18	19-24	>24	Weighted Average
Trucking	5	8	13	4	7	15	3.87
Automotive	3	7	3	1	1	1	2.56
Construction	3	8	8	4	2	8	3.55
Agriculture	3	1	3	-	1	2	3.10
Forestry	-	-	-	-	-	2	6.00

WITH ADDITIONAL DEGREES

Industry	Time (Months) <1	1-6	7-12	13-18	19-24	>24	Weighted Average
Trucking	2	8	5	2	-	4	3.10
Automotive	9	16	10	2	-	7	2.75
Construction	4	2	7	-	-	6	3.42
Agriculture	-	-	1	1	-	-	3.50
Forestry	-	-	1	-	-	-	3.00

APPENDIX XXI

COMPARISON OF NUMBER OF GRADUATES AND INDUSTRY TRAINING

TOTALS (ALL GRADS)

Industry	No. of Grads in Industry	No. of Courses	Courses per Grad Ratio
Trucking	117	96	0.82
Automotive	101	152	1.50
Construction	73	72	0.99
Agriculture	19	24	1.26
Forestry	6	3	0.50

WITHOUT ADDITIONAL DEGREES

Industry	No. of Grads in Industry	No. of Courses	Courses per Grad Ratio
Trucking	84	63	0.75
Automotive	31	39	1.25
Construction	49	45	0.92
Agriculture	16	18	1.13
Forestry	4	2	0.50

WITH ADDITIONAL DEGREES

Industry	No. of Grads in Industry	No. of Courses	Courses per Grad Ratio
Trucking	33	33	1.00
Automotive	70	113	1.61
Construction	24	27	1.13
Agriculture	3	5	2.00
Forestry	2	1	0.50

APPENDIX XXII

TYPES OF INDUSTRY TRAINING GRADUATES RECEIVED

Training Course	Total Trained	Without Add'l Degree No. Grads Trained	With Add'l Degree No. Grads Trained
Product Training	74	39	35
Diesel Engines	57	40	17
Electrical	24	11	13
Transport Refrigeration	16	13	3
Transmissions	15	7	8
Fuel Injection	14	9	5
Computerized Fuel Systems	12	3	9
Service Mgt Related	12	1	11
Electronic Fuel Injection	11	1	10
Hydraulics	11	9	2
Management	11	1	10
Automatic Transmissions	10	2	8
Drive Trains	9	7	2
Air Conditioners	8	4	4
Brakes	7	4	3
Customer Relations	7	-	4
Fuel Systems	7	3	4
Computers (P.C. use)	6	1	5
Gas Engines	6	2	4
Warranty	6	2	4
Engine Diagnosis	5	2	3
Parts	5	3	2
Troubleshooting	5	2	3
Emissions	4	2	2
Failure Analysis	4	3	1
Front Wheel Drives	4	-	4
Fuel Injection Pumps	4	3	1
Powershift Transmissions	4	4	-
Flight Training	3	-	3
Front End Alignment	3	3	-
Hydrostatic Transmissions	3	2	1
Steering Systems	3	1	2
Technical Training	3	-	3
Welder Maintenance	3	3	-
Totals	376	187	189

*Only those courses having three or more responses were included in this table. The total number is greater than the number of students responding because several attended more than one training course.

APPENDIX XXIII

ALPHA LISTING OF FACTORY SCHOOLS ATTENDED

IN	BU	JO	A	TY	FACTORY SCHOOLS	
02	02	04	y	03	Air Conditioning & Heating	
02	02	04	y	03	Air Conditioning & Heating	
05	01	01	n		Air Conditioning	(Ryder school)
02	02	10	y	03	Air Conditioning	(automotive)
02	01	01	n		Air Conditioning	(Chrysler)
05	08	01	n		Air Conditioning	(GM)
02	01	02	n		Air Conditioning Service	(Mazda)
05	01	01	y	01	Air Conditioning Systems	(CCOT; GM)
02	01	02	n		Automatic Transmissions	(GM 440-T4 trans. & update)
02	04	07	y	05	Automatic Transmissions	(automotive; 700 R4, GM)
02	01	03	n		Automatic Transmissions	(GMC / Chevrolet)
02	01	03	y	03	Automatic Transmissions	(truck; Allison)
02	02	04	y	03	Automatic Transmissions	(automotive)
02	02	04	y	03	Automatic Transmissions	(automotive)
02	02	04	y	05	Automatic Transmissions	(automotive)
02	02	04	y	03	Automatic Transmissions	(automotive)
02	02	05	y	03	Automatic Transmissions	(automotive)
02	02	05	y	03	Automatic Transmissions	(automotive)
02	02	05	y	03	Body & Paint	
02	01	03	y	03	Body & Paint	(paint school; Chevrolet)
05	01	01	n		Brakes	(truck; Hydro Max & Hydro Boost,Navistar IH)
05	08	01	n		Brakes	(H.D. truck; Ford-Orling-Lucas)
02	01	05	y	03	Brakes	(automotive; Teves anti-lock)
05	07	01	n		Brakes	(truck; Bendix)
02	02	04	y	03	Brakes	(hydraulic)
03	23	07	y	03	Brakes	(adjustments; Crawler Tractors)
05	08	03	n		Brakes	(air brake valves; Sealco)
28	32	05	n		Certified Mechanic Program	(Ford Tractor)
02	01	01	n		Computer Controlled Fuel Systems	(gas; GM)
05	08	01	y	01	Computer Controlled Fuel Systems	(gas, fundamentals)
02	01	05	n		Computer Controlled Fuel Systems	(gas; Chevrolet)
05	08	01	y	01	Computer Controlled Fuel Systems	(gas; advanced)
02	04	01	n		Computer Controlled Fuel Systems	(gas, GM)
05	01	01	y	01	Computer Controlled Fuel Systems	(gas, GM)
02	02	04	y	03	Computer Controlled Fuel Systems	(gas)
02	02	04	y	05	Computer Controlled Fuel Systems	(gas)
02	02	04	y	03	Computer Controlled Fuel Systems	(gas)
02	02	04	y	03	Computer Controlled Fuel Systems	(gas)
02	04	07	y	05	Computer Controlled Fuel Systems	(gas)

APPENDIX XXIII

ALPHA LISTING OF FACTORY SCHOOLS ATTENDED

IN	BU	JO	A	TY	FACTORY SCHOOLS
19	02	32	y	01	Computer Controlled Systems
05	34	01	n		Computers
02	02	04	y	03	Computers .... (software usage; specific systems)
02	02	04	y	03	Computers .... (information systems; general)
02	02	04	y	03	Computers .... (basic operation)
02	02	10	y	03	Computers .... (data processing)
02	01	03	y	03	Computers .... (administration)
03	43	01	n		Construction Mechanic School .... (U.S. Navy)
03	23	13	y	07	Crane Operators School .... (P & H Crane)
02	02	04	y	03	Cruise Control
05	10	01	n		Cruise Control .... (heavy truck; Bendix)
02	01	26	y	03	Customer Relations ...... (effective speaking; Dale Carnegie)
03	02	04	y	03	Customer Relations ...... (salesmanship training; John Deere)
02	02	04	y	05	Customer Relations .... (effective listening school; Ford)
02	01	26	y	03	Customer Relations .... (human relations; Dale Carnegie)
02	02	04	y	03	Customer Relations .... (anger diffusion; I.A.N.A.)
02	02	04	y	03	Customer Relations .... (owner relations)
02	01	18	y	03	Customer Relations .... (sales training)
03	01	01	n		Diesel Engines
01	02	01	n		Diesel Engines ...... (overhaul & tune-up; series 53 Detroit)
15	01	01	n		Diesel Engines .... (Detroit, model 53,71,& 92 schools)
03	01	18	n		Diesel Engines .... (troubleshooting; CAT 3208 & 3406)
03	10	02	n		Diesel Engines .... (troubleshooting; Cummins school)
05	01	01	n		Diesel Engines .... (6.9 liter glow plug system; IH)
05	01	01	n		Diesel Engines .... (basic 6.9 liter; Navistar IH)
05	08	02	n		Diesel Engines .... (in frame inspection; Cummins)
05	04	02	n		Diesel Engines .... (overhaul program; Cummins NT)
05	01	18	y	03	Diesel Engines .... (overhaul series 53; Detroit)
05	31	07	n		Diesel Engines .... (overhaul series 71; Detroit)
05	01	01	n		Diesel Engines .... (troubleshooting; Cummins NH)
02	01	03	y	03	Diesel Engines .... (series 72,92 & 53; Detroit)
02	02	04	y	03	Diesel Engines .... (5.7 liter advanced course)
05	03	08	y	04	Diesel Engines .... (series 92; Detroit Diesel)
05	07	01	y	01	Diesel Engines .... (rebuild; Detroit Diesel)
02	02	10	n		Diesel Engines .... (5.7 liter advanced; GM)
05	01	01	n		Diesel Engines .... (overhaul DT-360 NA; IH)
03	01	03	n		Diesel Engines .... (repair; Detroit Diesel)
05	07	01	y	07	Diesel Engines .... (overhaul 855; Cummins)
02	02	04	n		Diesel Engines .... (overhaul; Cummins NTC)

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ALPHA LISTING OF FACTORY SCHOOLS ATTENDED

IN	BU	JO	A	TY	FACTORY SCHOOLS
02	34	02	n		Diesel Engines .... (855 rebuild; Cummins)
05	01	01	n		Diesel Engines .... (Cummins NOW program)
03	01	01	n		Diesel Engines .... (rebuild; Cummins NH)
05	01	01	n		Diesel Engines .... (rebuild; Cummins NH)
03	01	05	y	03	Diesel Engines .... (overhaul; CAT 3406)
10	10	01	n		Diesel Engines .... (Series 71; Detroit)
05	08	02	n		Diesel Engines .... (overhaul; Cummins)
02	01	03	n		Diesel Engines .... (overhaul; Cummins)
05	04	01	n		Diesel Engines .... (rebuild; Cummins)
05	07	01	y	01	Diesel Engines .... (rebuild; Cummins)
05	01	01	n		Diesel Engines .... (rebuild; Cummins)
05	31	01	n		Diesel Engines .... (rebuild; Cummins)
03	01	28	y	01	Diesel Engines .... (Detroit Diesel)
03	02	05	n		Diesel Engines .... (Detroit Diesel)
03	02	04	y	05	Diesel Engines .... (Detroit Diesel)
02	02	04	y	03	Diesel Engines .... (6.2 liter; GM)
15	01	01	n		Diesel Engines .... (6.2 liter; GM)
02	02	10	n		Diesel Engines .... (6.2 liter; GM)
05	01	01	y	01	Diesel Engines .... (6.2 liter; GM)
05	02	04	y	01	Diesel Engines .... (9.0 liter; IH)
30	01	05	n		Diesel Engines .... (L-10; Cummins)
01	01	01	n		Diesel Engines .... (Cummins 903)
03	02	04	y	05	Diesel Engines .... (CAT school)
05	01	01	n		Diesel Engines .... (DT 360; IH)
05	03	08	y	04	Diesel Engines .... (DT 466; IH)
02	02	01	n		Diesel Engines .... (IH School)
02	01	03	y	03	Diesel Engines .... (CAT 3208)
03	02	05	n		Diesel Engines .... (Cummins)
02	01	01	n		Diesel Engines .... (Cummins)
03	06	02	n		Diesel Engines .... (Cummins)
05	11	01	n		Diesel Engines .... (Cummins)
15	01	02	n		Diesel Engines .... (Cummins)
02	01	03	y	03	Diesel Engines .... (Deutz)
01	01	02	n		Diesel Engines .... (White)
01	02	27	n		Diesel Engines .... (Case)
03	02	05	n		Diesel Engines .... (CAT)
05	07	01	y	07	Diesel Trucks .... (International Correspondence School)
05	14	13	n		Drive Trains .... (Ryder program)
02	02	04	y	03	Drive Trains .... (general)

APPENDIX XXIII

ALPHA LISTING OF FACTORY SCHOOLS ATTENDED

IN	BU	JO	A	TY	FACTORY SCHOOLS
02	01	03	n		Drive Trains .... (vibration diagnosis; GMC / Chevrolet)
03	01	01	n		Drive Trains .... (drive line vibrations; GM)
02	02	04	y	03	Drive Trains .... (differentials; front end)
02	02	10	n		Drive Trains .... (truck axles; Rockwell)
01	02	27	n		Drive Trains .... (crawler power trains)
32	32	05	n		Drive Trains .... (truck; Oshkosh)
02	02	01	n		Drive Trains .... (IH School)
02	02	05	y	03	Driveability
02	02	04	y	03	Driveability .... (automotive; with gas fuel injection)
05	01	01	y	01	Electrical
05	14	13	n		Electrical & Carburation .... (Ryder program)
05	07	01	y	07	Electrical .. (troubleshooting; alternator & starter systems)
05	08	02	n		Electrical .... (start & charge system diagnosis & repair)
05	07	01	n		Electrical .... (starter & alternator systems; A.C.Delco)
02	02	10	n		Electrical .... (theory & basic circuits)
02	02	04	y	03	Electrical .... (direct ignition system)
05	30	01	n		Electrical .... (repair; GM Tech Center)
04	01	01	n		Electrical .... (Valley Engineering)
05	30	01	n		Electrical .... (A.C. Delco school)
02	01	03	n		Electrical .... (GMC / Chevrolet)
02	02	04	y	03	Electrical .... (several courses)
05	03	08	y	04	Electrical .... (starter seminar)
02	02	04	y	03	Electrical .... (meter usage)
03	01	01	n		Electrical .... (EMS, CAT)
02	02	04	y	03	Electrical Diagnosis
02	02	04	y	05	Electrical Diagnosis
02	02	04	y	03	Electrical Diagnosis
02	02	05	y	03	Electrical Systems
19	02	32	y	01	Electrical Systems
02	02	04	y	05	Electrical Systems .... (Ford)
02	02	01	n		Electrical Systems .... (IH School)
02	02	04	y	03	Electrical Systems .... (truck)
32	32	05	n		Electrical Troubleshooting .... (trucks; Oshkosh)
02	02	04	y	03	Electronic Engine Controls .... (gas)
05	34	01	n		Electronic Fuel Injection
05	08	01	y	03	Electronic Fuel Injection
05	08	01	y	01	Electronic Fuel Injection .... (gas; advanced port)
02	02	04	y	03	Electronic Fuel Injection .... (gas)
02	02	04	y	05	Electronic Fuel Injection .... (gas)

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ALPHA LISTING OF FACTORY SCHOOLS ATTENDED

IN	BU	JO	A	TY	FACTORY SCHOOLS
02	02	04	y	03	Electronic Fuel Injection .... (gas)
02	02	04	y	03	Electronic Fuel Injection .... (gas)
02	02	05	y	03	Electronic Fuel Injection .... (gas)
02	01	01	y	03	Electronic Fuel Systems .... (oxygen feedback; Chrysler)
02	31	07	y	01	Electronic Fuel Systems .... (gas; GM)
05	03	08	y	04	Electronic Ignition Systems .... (Prestolite)
02	02	05	y	03	Electronic Ignition Systems .... (gas)
05	08	01	y	01	Electronics .... (specialized training)
02	02	04	y	03	Electronics .... (specialized)
05	08	01	y	03	Emission Control Systems
02	02	04	y	03	Emissions & Fuel
05	10	01	n		Emissions .... (medium & heavy truck; Ford)
02	01	02	n		Emissions Update .... (Mazda)
03	01	01	n		Engine Diagnostics
05	01	01	y	01	Engine Performance .... (gas, GM 250)
02	02	04	y	03	Engine Performance .... (gas)
02	02	04	y	03	Engine Service .... (gas)
05	01	01	n		Engines .... (rebuild; Jasper Engines)
03	01	01	n		Failure Analysis
03	01	01	n		Failure Analysis
03	01	01	y	02	Failure Analysis .... (CAT school)
03	01	01	n		Failure Analysis .... (CAT)
05	08	03	n		Fifth Wheels .... (Holland Hitch)
17	43	39	y	03	Flight Training Schools .... (U.S. Navy)
17	43	39	y	05	Flight Training Schools .... (U.S.M.C.)
17	43	05	y	03	Flight Training Schools, Helicopter .... (U.S.M.C.)
05	01	02	n		Front End Alignment ..... (C-111 for trucks & busses; Hunter)
02	47	49	n		Front End Alignment .... (computerized automotive, Bear)
02	31	01	n		Front End Alignment .... (service school; Kmart)
02	02	04	y	03	Front wheel Drive & Drive Lines
02	02	04	y	03	Front Wheel Drive .... (180 C transmission & transaxle)
19	02	32	y	01	Front Wheel Drive .... (transaxles; automatic & manual)
02	02	04	y	05	Front Wheel Drive .... (transaxle update)
05	01	01	n		Fuel Injection .... (troubleshooting; DT-466 engine; IH)
02	31	01	n		Fuel Injection .... (gas advanced, GM Tech Center)
03	01	01	n		Fuel Injection .... (diesel; pump & governor)
01	10	22	n		Fuel Injection .... (troubleshooting; CAT)
03	01	01	n		Fuel Injection .... (pumps; CAT 3406 B)
02	01	01	n		Fuel Injection .... (gas, Chrysler)

APPENDIX XXIII

ALPHA LISTING OF FACTORY SCHOOLS ATTENDED

IN	BU	JO	A	TY	FACTORY SCHOOLS
05	14	13	n		Fuel Injection .... (Ryder program)
02	01	02	n		Fuel Injection .... (Volkswagon)
05	08	01	y	01	Fuel Injection .... (gas; port)
02	02	08	y	03	Fuel Injection .... (Renault)
03	23	07	y	03	Fuel Injection .... (diesel)
02	02	04	y	03	Fuel Injection .... (gas)
02	01	03	n		Fuel Injection Pump Rebuild .... (diesel; Standyne DB2)
02	02	04	y	03	Fuel Injection Pumps .... (repair; Roosa Master DB2)
03	01	01	n		Fuel Injection Pumps .... (small bore)
03	01	01	n		Fuel Injection Systems .... (diesel, CAT 3306 & 3208)
02	02	10	y	03	Fuel Injection Systems .... (gas)
02	01	03	n		Fuel Injectors .... (diesel; Detroit Diesel unit inj.)
03	01	01	n		Fuel Pump .... (diesel, scroll)
03	01	05	y	03	Fuel System Diagnosis 2 .... (CAT 3406)
03	01	05	y	03	Fuel System Diagnosis 3 .... (CAT 3406B)
05	01	01	n		Fuel Systems .... (diesel; rebuild & calibration, Cummins)
03	01	01	y	02	Fuel Systems .... (diesel, CAT backhoe / Perkins engine)
02	01	01	n		Fuel Systems .... (gas, Mikuni carburator; Chrysler)
05	04	02	n		Fuel Systems .... (Diesel; Cummins program)
03	01	01	y	02	Fuel Systems .... (diesel, CAT B series)
02	01	05	y	03	Gas Engines .... (Quad 4 mechanical & electrical systems)
02	03	01	y	02	Gas Engines .... (Briggs & Stratton specifications)
02	03	01	y	02	Gas Engines .... (Wisconsin specifications)
19	04	01	n		Gas Engines .... (Briggs & Stratton)
02	02	10	n		Gas Engines .... (3.8 liter M.F.I.)
02	02	04	y	03	Gas Engines .... (repair)
03	23	07	y	03	Hydraulics
03	23	07	n		Hydraulics
03	01	01	n		Hydraulics .... (Pressure sensing, load compensating)
03	01	01	n		Hydraulics .... (pressure sensing flow compensating)
05	04	05	n		Hydraulics .... (Great Lakes Hydraulics)
04	01	01	n		Hydraulics .... (Valley Engineering)
09	02	07	n		Hydraulics .... (John Deere)
03	01	01	n		Hydraulics .... (excavator)
01	02	27	n		Hydraulics .... (crawlers)
04	10	02	y	03	Hydraulics .... (Vickers)
03	01	01	n		Hydraulics .... (dozer)
03	01	05	y	03	Hydrostatic Loader .... (diagnosis & service)
01	01	01	n		Hydrostatic Transmissions .... (diagnosis; Bobcat)

APPENDIX XXIII

ALPHA LISTING OF FACTORY SCHOOLS ATTENDED

IN	BU	JO	A	TY	FACTORY SCHOOLS
09	02	07	n		Hydrostatic Transmissions .... (John Deere)
02	02	04	y	05	Independent Channel School .... (Ford)
17	43	01	n		Light Armored Technician School .... (military)
02	02	04	y	03	Management .... (parts zone manager school)
02	02	04	y	03	Management .... (zone manager school; Ford)
02	02	04	y	03	Management .... (zone manager school; BMW)
02	02	04	y	05	Management .... (time management; Ford)
02	02	04	y	03	Management .... (interpersonal skills)
02	01	03	n		Management .... (GMC / Chevrolet)
02	02	04	y	03	Management .... (time management)
03	02	04	y	03	Management .... (time management)
02	01	18	y	03	Management .... (financial)
02	01	18	y	03	Management .... (personnel)
02	02	04	y	03	Management .... (Business)
03	02	01	y	05	Oil Exploration Equip .... (DMT & Vibro 2 schools; T.I.)
31	01	41	n		Oil Exploration Equip .... (vibrator mechanic training)
02	02	04	y	05	Parts & Service School .... (dealer; Ford)
02	01	28	n		Parts Catalog School .... (basic use)
02	01	28	n		Parts Inventory School .... (Reynolds & Renolds Inv. 2)
01	01	06	y	03	Parts Training .... (DPARTS ordering; John Deere)
05	10	28	n		Parts Training .... (counterman; Freightliner)
05	01	01	y	01	Pneumatics
11	18	02	y	03	Power Generation .... (GM Electromotive Divison)
03	01	13	n		Powershift Transmissions
03	01	01	n		Powershift Transmissions
03	01	01	n		Powershift Transmissions .... (control systems)
03	01	01	n		Powershift Transmissions .... (basic)
02	02	04	y	03	Product Training
03	01	13	n		Product Training .... (hydraulic excavators)
03	01	13	n		Product Training .... (concrete pavers)
30	01	03	n		Product Training . (fork lift; SRC control electric circuits)
03	02	04	y	03	Product Training ..... (cutting edge & blade school; Bucyrus)
02	02	04	y	03	Product Training ...... (several courses; GM Training Center)
03	01	01	n		Product Training .... (Rollers, Planer, & Grader schools)
05	10	01	n		Product Training .... (fork lift school; Crown Electric)
03	01	28	y	01	Product Training .... (air compressors; Ingersoll-Rand)
03	01	01	n		Product Training .... (EL-300 hydraulic excavator; CAT)
29	30	01	n		Product Training .... (combine repair; allis Chalmers)
01	01	01	n		Product Training .... (combine service training; Gehl)

APPENDIX XXIII

ALPHA LISTING OF FACTORY SCHOOLS ATTENDED

IN	BU	JO	A	TY	FACTORY SCHOOLS
05	10	01	n		Product Training .... (redi-mix truck school; Oshkosh)
29	30	01	n		Product Training .... (tractor repair; Allis Chalmers)
02	02	04	y	03	Product Training .... (various technical schools; BMW)
02	02	04	y	03	Product Training .... (several courses; GM Tng. Ctr.)
05	01	18	y	03	Product Training .... (truck rear axles; Spicer/Dana)
03	01	01	n		Product Training .... (all wheel drive graders; CAT)
28	01	28	n		Product Training .... (commercial turf mowers; Toro)
02	02	04	y	03	Product Training .... (new car conditioning service)
05	02	10	n		Product Training .... (several service programs; GM)
05	01	01	n		Product Training .... (fork lift electrical; Clark)
02	02	05	y	03	Product Training .... (several courses; GM Tng Ctr)
03	01	28	y	03	Product Training .... (Toyota Industrial Equipment)
03	02	01	y	05	Product Training .... (various schools, Fiat-Allis)
02	02	05	y	03	Product Training .... (various courses, Chevrolet)
28	01	28	n		Product Training .... (golf cart school; Cushman)
01	01	03	y	01	Product Training .... (service school; Versatile)
02	01	01	n		Product Training .... (several GM & Jeep schools)
01	01	03	n		Product Training .... (skid-steer loader; Bobcat)
05	45	18	n		Product Training .... (snowplow service; Western)
05	34	01	n		Product Training .... (aerial lift; High Ranger)
03	06	01	n		Product Training .... (aerial lift; High Ranger)
05	01	01	n		Product Training .... (beginning manuals; Volvo)
02	01	03	y	03	Product Training .... (cams 1 school; Chevrolet)
02	01	03	y	03	Product Training .... (cams 2 school; Chevrolet)
03	01	03	n		Product Training .... (excavator repair; Insley)
05	07	02	n		Product Training .... (in-house update training)
03	01	01	n		Product Training .... (416 & 428 backhoes; CAT)
01	10	01	n		Product Training .... (combine training school)
02	02	04	y	03	Product training .... (pre-delivery inspection)
03	01	28	y	03	Product Training .... (Detroit Diesel Allison)
03	01	01	n		Product Training .... (crane school; Gallion)
16	02	27	y	03	Product Training .... (fork lift school; CAT)
01	01	03	y	01	Product Training .... (service school; White)
03	01	03	n		Product Training .... (trencher school; Case)
03	01	01	n		Product Training .... (aerial lift; Economy)
02	02	04	y	03	Product Training .... (new car conditioning)
02	02	10	y	03	Product Training .... (several seminars; GM)
28	32	05	n		Product Training .... (tractor school; Ford)
01	01	02	n		Product Training .... (corn planters; Gehl)

APPENDIX XXIII

ALPHA LISTING OF FACTORY SCHOOLS ATTENDED

IN	BU	JO	A	TY	FACTORY SCHOOLS
01	02	27	n		Product Training .... (excavators; Poclain)
02	34	02	y	01	Product Training .... (Iveco 2 Van, Diesel)
02	01	26	y	03	Product Training .... (New Car Highlights)
30	01	05	n		Product Training .... (new equipment prep)
01	01	03	y	01	Product Training .... (service school; IH)
01	01	06	y	03	Product Training .... (forage harvesters)
03	01	01	n		Product Training .... (aerial lift; JLG)
03	01	13	n		Product Training .... (paving equipment)
02	01	02	n		Product Training .... (new RX-7; Mazda)
05	01	01	y	01	Product Training .... (S-15 pickup; GM)
01	01	06	y	03	Product Training .... (square balers)
03	01	01	y	02	Product Training .... (Tanquay LL228)
01	02	27	n		Product Training .... (wheel loaders)
01	10	01	n		Product Training .... (baler School)
03	01	28	y	03	Product Training .... (Eaton-Fuller)
03	02	05	n		Product Training .... (Freightliner)
03	01	28	y	03	Product Training .... (John Deere)
05	08	02	y	03	Product Training .... (John Deere)
01	02	27	n		Product Training .... (trenchers)
03	01	28	y	03	Product Training .... (J.C.B.)
03	01	28	y	03	Product Training .... (Hitachi)
03	01	28	y	03	Product Training .... (Komatsu)
02	01	05	y	03	Product Training .... (Buick)
03	01	01	y	01	Pumps .... (Rough Rider oil field fluid pumps)
02	01	26	y	03	Service Advising .... (video Tape programs)
02	01	05	y	03	Service Advisor School
02	01	05	n		Service Advisor School .... (Chevrolet)
02	02	04	y	03	Service Advisor Training
09	20	17	y	03	Service Management .... (shop management; Midas)
02	02	04	y	03	Service Management .... (GM School)
02	01	03	y	03	Service Management .... (basic)
02	01	03	y	03	Service Manager School .... (Chevrolet)
02	01	03	y	03	Service Managers Seminar .... (Chrysler)
09	20	17	y	03	Service Sales .... (Firestone)
02	02	04	y	03	Service Zone Manager
02	02	04	y	05	Service Zone Manager School .... (Ford)
10	10	01	n		Special Equipment .... (IHC)
02	01	03	n		Statistical Problem Solving
02	01	03	n		Statistical Process Control

APPENDIX XXIII

ALPHA LISTING OF FACTORY SCHOOLS ATTENDED

IN	BU	JO	A	TY	FACTORY SCHOOLS
02	02	04	y	03	Steering & Suspension Systems
02	02	04	y	03	Steering Systems
05	04	05	n		Steering Systems .... (Ross power steering; TRW school)
17	43	01	y	02	Tank & Tow Vehicles Schools .... (several, U.S. Army)
02	01	03	y	03	Tech 1 School .... (Chevrolet)
02	02	05	y	05	Technical Seminar .... (GM)
02	02	04	y	05	Technical Training .... (basic; Ford)
05	08	02	n		Tire Maintenance .... (Ryder)
05	02	04	y	04	Transmission Repair .... (truck; Fuller)
03	01	18	n		Transmissions .... (troubleshooting & rebuilding)
05	03	08	y	04	Transmissions .... (5 speed recall; IH)
02	02	04	y	03	Transmissions .... (automotive; manual)
02	02	04	y	03	Transmissions .... (automotive; repair)
02	02	04	y	05	Transmissions .... (5 speed overdrive)
02	02	10	n		Transmissions .... (truck; Fuller)
05	02	04	y	01	Transmissions .... (truck; Fuller)
05	08	02	n		Transmissions .... (truck; Fuller)
05	01	01	n		Transmissions .... (truck; Fuller)
03	23	06	y	01	Transmissions .... (truck; Fuller)
05	03	08	y	04	Transmissions .... (truck; Fuller)
05	04	05	n		Transmissions .... (truck; Fuller)
02	02	10	n		Transmissions .... (truck; Eaton)
05	08	01	n		Transmissions .... (truck; Eaton)
05	08	01	y	03	Transport Refrigeration
05	08	03	n		Transport Refrigeration .... (Thermo King)
05	08	03	n		Transport Refrigeration .... (Carrier)
05	01	01	n		Transport Refrigeration & Electrical .... (Thermo King)
05	34	02	y	03	Transport Refrigeration & Electrical .... (Thermo King)
01	10	22	n		Transport Refrigeration ...... (troubleshooting; Thermo King)
02	34	02	n		Transport Refrigeration .... (basic, Thermo King)
05	03	08	y	04	Transport Refrigeration .... (basic training)
05	01	01	n		Transport Refrigeration .... (Ryder school)
05	10	01	n		Transport Refrigeration .... (Thermo King)
05	08	01	n		Transport Refrigeration .... (Thermo King)
05	07	01	n		Transport Refrigeration .... (Thermo King)
05	30	01	n		Transport Refrigeration .... (Thermo King)
05	30	01	n		Transport Refrigeration .... (Carrier)
05	01	01	n		Transport Refrigeration .... (Carrier)
05	08	02	n		Transport Refrigeration .... (Ryder)

APPENDIX XXIII

ALPHA LISTING OF FACTORY SCHOOLS ATTENDED

IN	BU	JO	A	TY	FACTORY SCHOOLS
05	30	01	n		Trim Repair .... (GM Tech Center)
02	01	03	n		Troubleshooting .... (automatic transmissions; Allison)
05	08	02	y	03	Troubleshooting .... (engines, Cummins)
05	08	02	y	03	Troubleshooting .... (engines, CAT)
02	02	04	y	03	Troubleshooting .... (electrical)
01	02	01	n		Troubleshooting Busses ... (All systems, company owned units)
02	02	04	y	03	Truck Driving School .... (Ryder)
02	02	05	y	03	Turbocharging .... (gas)
05	01	01	n		Vehicle Engineering 1 .... (Ryder school)
02	01	03	y	03	Warranty & Policy
02	01	05	y	03	Warranty Administration .... (Detroit Diesel Allison)
02	01	26	y	03	Warranty Administration .... (Nissan)
07	01	03	n		Warranty Administration .... (Ford)
05	08	02	n		Warranty Classes .... (Ryder)
05	08	01	y	03	Warranty Procedures
02	02	04	y	03	Water Leak Detection
02	02	05	y	03	Water Leaks
19	04	01	n		Welder Maintenance School .... (Miller,Lincoln & Hobard)
19	04	01	n		Welder Maintenance School .... (Cyclomatic, Inc.)
03	01	01	n		Welder Troubleshooting & Repair .... (Hobart)
02	02	04	y	03	Wind Noise
02	02	05	y	03	Wind Noise

APPENDIX XXIV

CODES FOR ANALYZING RECOMMENDATIONS AND COMMENTS

In - Industry Codes

01	Agriculture	17	Military
02	Automotive	18	Defense
03	Construction	19	Maintenance (Plant)
04	Forestry	20	Secondary Education
05	Trucking	22	Hydraulics
06	Generator Sets	23	Industrial Forklifts
07	Marine	24	Welding
09	Other	25	Lawn and Garden
10	Oil and Gas	27	Motorcycles
11	Railroad	28	Golf and Turf Distributor
12	Retail Store	29	City Water Supply
13	Communications	30	Forklifts
15	Engines	31	Woodworking Plant
16	Power Plant	32	Skiing Resort

Bu - Business Codes

01	Retail Distributor	19	Telephone Co. (Long Distance)
02	Manufacturer	20	Consultant
03	Educational Inst.	23	Contractor
04	Specialty Shop	27	Aero Space
06	Utilities Co.	30	Municipality
07	Trucking	31	Independent Repair Shop
08	Rental Leasing	32	Recreational Facility
09	Wholesale Nursery	34	Fleet Operation
10	User Shop	35	Tool and Die
11	Busses	36	Technical Publications
12	Insurance	37	Advertising Agency
14	Moving and Rigging	39	Industrial Pump Dist.
15	State of Michigan	43	Military
16	Oil and Gas	45	Parts and Service Sales
17	Coal Mining	47	Print Shop
18	Railroad	48	Package Delivery Service

* Numbers missing in the numerical sequence indicates previous consolidation.

APPENDIX XXIV (CONTINUED)

CODES FOR ANALYZING RECOMMENDATIONS AND COMMENTS

Jo - Job Codes

01	Service Technician	23	Bus Safety Inspector
02	Shop Foreman	26	Service Advisor
03	Service Manager	27	Engineer
04	Factory Serv. Rep.	28	Parts Manager
05	Middle Management	29	Plant Maint. (Millwright)
06	Top Mgt (Not owner)	30	Warranty
07	Business Owner	32	Electronics Technician
08	Instructor	33	Die Polisher
09	Other	34	Student
10	Engineering Tech.	35	Pilot
12	Claims Rep.	41	Factory Worker (general)
13	Driver/Equip. Oper.	43	Derrick Hand
14	Mech. Cert. Analyst	45	Radar Technician
16	Satelite Tech.	49	Press Helper
17	Fiscal Analyst	50	Microwave Sys. Technician
18	Sales	51	Mining Technician
19	Const. Estimator	53	Die Maker
22	Farmer		

* Numbers missing in the numerical sequence indicates previous consolidation.

Ty - Type Additional Degree Code

--	Blank - no additional degrees
01	Auto Service
02	Auto Machine
03	AHM (AHT)
04	Trade Technical Teaching
05	Business
06	Engineering
07	Other

APPENDIX XXV

TYPE OF SCHOOLS OFFERED BY TRUCKING INDUSTRY

Training Course	Total No. Grads Trained	Without Add'l Degrees No. Grads Trained	With Add'l Degrees No. Grads Trained
Diesel Engines	23	15	8
Transport Refrigeration	14	11	3
Product Training	11	8	3
Electrical	8	5	3
Transmissions	8	4	4
Brakes	4	4	-
Air Conditioning	3	2	1
Computerized Fuel Systems	3	-	3
Electronic Fuel Injection	3	1	2
Fuel Injection	3	2	1
Emissions	2	1	1
Engine Diagnosis	2	1	1
Fuel Systems	2	2	-
Troubleshooting	2	-	2
Warranty	2	1	1
Computers (P.C. use)	1	1	-
Drive Trains	1	1	-
Front End Alignment	1	1	-
Hydraulics	1	1	-
Parts	1	1	-
Steering Systems	1	1	-
Totals	96	63	33

APPENDIX XXVI

TYPE OF SCHOOLS OFFERED BY AUTOMOTIVE INDUSTRY

Training Course	Total No. Grads Trained	Without Add'l Degree No. Grads Trained	With Add'l Degree No. Grads Trained
Product Training	17	2	15
Diesel Engines	12	7	5
Electrical	12	3	5
Automatic Transmissions	10	2	8
Management	10	1	9
Service Management Related	10	1	9
Computerized Fuel Systems	8	3	5
Electronic Fuel Injection	8	-	8
Customer Relations	6	-	6
Fuel Injection	6	3	3
Air Conditioning	5	2	3
Computers (P.C. use)	5	-	5
Drive Trains	5	3	2
Gas Engines	5	1	4
Trasnmissions	5	2	3
Front Wheel Drive	3	-	3
Parts	3	2	1
Technical Training	3	-	3
Warranty	3	-	3
Brakes	2	-	2
Emissions	2	1	1
Engine Diagnosis	2	-	2
Front End Alignment	2	2	-
Fuel Injection Pumps	2	1	1
Steering Systems	2	-	2
Troubleshooting	2	1	1
Fuel Systems	1	1	-
Transport Refrigeration	1	1	-
Totals	152	39	113

APPENDIX XXVII

TYPE OF SCHOOLS OFFERED BY CONSTRUCTION INDUSTRY

Training Course	Total No. Grads Trained	Without Add'l Degree No. Grads Trained	With Add'l Degree No. Grads Trained
Product Training	25	14	11
Diesel Engines	13	9	4
Hydraulics	6	5	1
Failure Analysis	4	3	1
Fuel Injection	4	3	1
Fuel Systems	4	-	4
Powershift Transmissions	4	4	-
Fuel Injection Pumps	2	2	-
Transmissions	2	1	1
Brakes	1	-	1
Customer Relations	1	-	1
Drive Trains	1	1	-
Electrical	1	1	-
Engine Diagnosis	1	1	-
Hydrostatic Transmissions	1	-	1
Management	1	-	1
Welder Maintenance	1	1	-
Total	72	45	27

APPENDIX XXVIII

TYPE OF SCHOOLS OFFERED BY AG. AND FORESTRY INDUSTRIES

AGRICULTURE

Training Course	Total No. Grads Trained	Without Add'l Degrees No. Grads Trained	With Add'l Degrees No. Grads Trained
Product Training	13	8	5
Diesel Engines	4	4	-
Drive Trains	1	1	-
Fuel Injection	1	1	-
Hydraulics	1	1	-
Hydrostatic Transmissions	1	1	-
Parts	1	-	1
Transport Refrigeration	1	1	-
Troubleshooting	1	1	-
Totals	24	18	6

FORESTRY

Training Course	Total No. Grads Trained	Without Add'l Degrees No. Grads Trained	With Add'l Degrees No. Grads Trained
Hydraulics	2	1	1
Electrical	1	1	-
Totals	3	2	1

APPENDIX XXIX
INDUSTRY FIT TO SURVEY TASK INVENTORY
(ALL RECORDS)

TASKS	AG	AUTO	CONST.	FORESTRY	TRUCK	OTHER	SUM	AVG
Air Brakes T-Shooting	1.20	.48	1.51	1.83	2.32	.81	8.15	1.36
Hydraulic Brakes T-Shooting	1.70	1.42	1.63	2.00	1.42	.84	9.01	1.50
Rebuild Major Brake Components	1.30	.89	1.67	1.33	1.75	.77	7.71	1.29
Turn Brake Drums or Rotors	.25	1.16	.52	.17	.73	.45	3.28	.55
A/C Sys T-Shooting	1.85	1.40	.73	.50	1.73	.37	6.58	1.10
A/C Component Rebuild	.30	.61	.33	.17	.53	.23	2.17	.36
Diesel Engine Overhaul	2.10	.76	1.95	1.83	1.77	.88	9.29	1.55
Gasoline Engine Overhaul	1.85	1.26	1.31	1.50	1.14	.79	7.85	1.31
LP Gas Engine Overhaul	.25	.13	.28	.00	.38	.29	1.33	.22
Diff. Cone Point Setting	.65	.35	1.05	.67	.58	.22	3.52	.59
Rebuild Planetary Hubs	1.10	.40	1.67	1.67	.40	.40	5.64	.94
Carbeuration Sys. T-Shooting	1.95	1.40	1.28	.83	1.21	.90	7.57	1.26
Carbeurator Overhaul	1.85	1.13	1.05	1.00	.91	.88	6.82	1.14
Diesel Inj. Sys. T-Shooting	2.25	.95	2.00	2.33	2.05	1.09	10.67	1.78
Diesel Inj. Clean & Setting	1.55	.50	1.27	1.83	1.14	.62	6.91	1.15
Diesel Inj. Pump Overhaul	.25	.30	.52	.33	.32	.35	2.07	.35
Diesel Inj. Pump Calibration	.20	.27	.55	.00	.42	.33	1.77	.30
Electronic Fuel Inj. Service	.50	1.41	.31	.33	.61	.35	3.51	.59
Electrical Lighting T-Shooting	2.50	1.62	2.26	2.83	2.57	1.31	13.09	2.18
Elec. Start & Charge T-Shoot	2.50	1.70	2.42	3.00	2.54	1.42	13.58	2.26
Electrical Ignition T-Shooting	2.10	1.64	1.71	2.17	1.70	1.11	10.43	1.74
Elec. Computer Control T-Shoot	.45	1.67	.89	1.00	.84	.84	5.69	.95
Gen./Alternator Rebuild	1.20	.84	.82	1.17	.43	.65	5.11	.85
Starter Rebuild	1.10	.73	.86	1.50	.37	.44	5.00	.83
Electronic Ignition Systems	.75	1.52	.76	1.00	1.06	.72	5.81	.97
Ignition Sys. Scope Analysis	.10	1.16	.26	.17	.39	.32	2.40	.40
Hydraulics T-Shooting	2.30	.79	2.50	2.50	1.36	1.37	10.82	1.80
Hydraulics Component Rebuild	2.05	.51	2.27	2.50	.83	1.13	9.29	1.55
Manual Transmission Rebuild	1.55	.89	1.34	.67	1.21	.58	6.24	1.04
Automatic/P.S. Trans. T-Shoot	1.40	1.14	1.57	.67	.89	.68	6.35	1.06
Automatic/P.S. Trans. Rebuild	1.10	.81	1.28	.33	.47	.47	4.46	.74
Hydrostatic Trans. T-Shoot	1.45	.23	1.39	1.17	.40	.65	5.29	.88
Hydrostatic Trans. Rebuild	.75	.19	.92	.83	.26	.51	3.46	.58
Suspension Sys. Alignment	.50	1.19	.59	1.17	1.59	.53	5.57	.93
Suspension Sys. Rebuild	.50	1.06	.88	1.67	1.83	.55	6.49	1.08
Front Axle Rebuild	.80	.74	1.10	1.00	1.57	.58	5.79	.97
Pin & Bush Track Systems	.30	.19	1.38	1.50	.32	.32	4.01	.67
TOTALS (SUM)	44.50	33.44	44.83	45.17	40.04	24.75	232.73	38.82
TOTALS (AVG)	1.20	.90	1.21	1.22	1.08	.67	6.29	1.05

APPENDIX XXX

DISTRIBUTION OF GRADUATES BY ADDITIONAL DEGREES

Degrees Earned	No. of Graduates	% of Total Graduates
Heavy Equipment Associates Only	213	58.2
Additional Degrees		
Associates (Second)		
Auto Service	31	8.5
Auto Machine	9	2.5
Business	3	0.8
Engineering	1	0.3
Other	12	3.3
Total	56	
Associates (Second & Third)		
Auto Service & Auto Machine	3	0.8
Bachelors		
AHM (AHT)	88	24.0
Business	10	2.7
Teaching	10	2.7
Engineering	3	0.8
Total	111	
Masters		
Business	1	0.3

APPENDIX XXXI

JOBS HELD BY GRADUATES WITH ADDITIONAL ASSOC. DEGREES

Second Associates

Job	Auto Service	Auto Machine	Business	Engineer	Other
Service Technician	15	5	1	-	3
Shop Foreman	2	-	-	-	1
Service Manager	1	-	-	-	-
Factory Serv. Rep.	3	1	1	-	1
Middle Management	1	-	1	-	-
Top Management	1	-	-	-	1
Business Owner	4	-	-	-	3
Instructor	-	1	-	-	-
Other	4	2	-	1	3
Totals	31	9	3	1	12

Third Associates

Job	Auto Machine*
Service Technician	1
Business Owner	2

*All three of these Heavy Equipment Graduates also earned a second associates degree in Auto Service.

APPENDIX XXXII

JOBS HELD BY GRADUATES WITH ADVANCED DEGREES

Bachelors

Job	AHM(AHT)	Education	Business	Engineering
Service Technician	3	3	2	1
Shop Foreman	6	-	1	-
Service Manager	8	-	-	-
Factory Service Rep.	22	2	2	-
Middle Management	13	-	1	-
Top Management	2	-	-	-
Owner	3	-	1	-
Instructor	1	3	-	-
Sales	6	-	-	-
Service Advisor	5	-	-	-
Engineering Technician	4	-	-	-
Engineer	4	-	-	-
Parts Manager	2	-	-	-
Claims Representative	1	-	-	-
Driver/Equip. Operator	1	-	-	-
Mechanic Certification Analyst	1	-	-	-
Fiscal Analyst	1	-	-	-
Bus Safety Inspector	1	-	-	-
Warranty	1	-	-	-
Die Polisher	1	-	-	-
Pilot	1	-	-	-
Other	1	2	3	2
Totals	88	10	10	3

Masters

Job	Business*
Warranty Supervisor	1

*Graduate also earned a Bachelors Degree in Business and is presently pursuing a Degree in Law.

APPENDIX XXXIII

INDUSTRIES EMPLOYING GRADUATES WITH ADDITIONAL ASSOCIATES DEGREES

Second Associates

Industry	Auto Service	Auto Machine	Business	Engineering	Other
Agriculture	1	-	-	-	1
Automotive	10	4	1	1	3
Construction	4	2	1	-	4
Forestry	1	-	-	-	1
Trucking	12	2	-	-	1
Marine	1	-	-	-	1
Other	2	1	1	-	1
Totals	31	9	3	1	12

Third Associates

Industry	Auto Machine*
Automotive	2
Construction	1

*All three of these Heavy Equipment Graduates also earned a second Associates Degree in Auto Service.

APPENDIX XXXIV

INDUSTRIES EMPLOYING GRADUATES WITH ADVANCED DEGREES

Bachelors

Industry	AHM(AHT)	Teaching	Business	Engineering
Agriculture	1	-	-	-
Automotive	52	1	5	1
Construction	10	2	1	1
Forestry	1	-	-	-
Trucking	14	5	-	-
Oil and Gas	-	-	2	-
Railroad	1	-	-	-
Engines	-	-	-	1
Powerplant	1	-	-	-
Military	2	1	1	-
Defense	1	-	-	-
Maintenance (Plant)	1	-	1	-
Lawn and Garden	1	-	-	-
Other	3	1	-	-
Totals	88	10	10	3

Masters

Industry	Business*
Automotive	1

*Graduate also earned a Bachelors Degree in Business and is presently pursuing a Degree in Law.

APPENDIX XXXV
INDUSTRY FIT TO SURVEY TASK INVENTORY
(WITH NO ADDITIONAL DEGREES)

TASKS	AG	AUTO	CONST.	FORESTRY	TRUCK	OTHER	SUM	AVG
Air Brakes T-Shooting	1.24	.63	1.67	1.75	2.41	.87	8.57	1.43
Hydraulic Brakes T-Shooting	1.76	1.50	1.81	2.00	1.47	.92	9.46	1.58
Rebuild Major Brake Components	1.29	1.10	1.83	1.25	1.77	.92	8.16	1.36
Turn Brake Drums or Rotors	.18	1.19	.53	.25	.75	.54	3.44	.57
A/C Sys T-Shooting	1.82	1.53	.81	.25	1.73	.43	6.57	1.10
A/C Component Rebuild	.35	.50	.32	.00	.49	.30	1.96	.33
Diesel Engine Overhaul	2.12	.97	2.00	1.75	1.66	.92	9.42	1.57
Gasoline Engine Overhaul	1.88	1.06	1.30	1.25	1.18	1.00	7.67	1.28
LP Gas Engine Overhaul	.29	.22	.19	.00	.38	.29	1.37	.23
Diff. Cone Point Setting	.76	.31	1.15	.50	.55	.13	3.40	.57
Rebuild Planetary Hubs	1.18	.26	1.81	1.75	.39	.46	5.85	.98
Carbeuration Sys. T-Shooting	1.88	1.42	1.36	.50	1.25	1.00	7.41	1.24
Carbeurator Overhaul	1.82	1.09	1.13	.75	.92	1.00	6.71	1.12
Diesel Inj. Sys. T-Shooting	2.35	.97	2.11	2.25	1.99	1.21	10.88	1.81
Diesel Inj. Clean & Setting	1.71	.34	1.23	1.75	1.13	.56	6.72	1.12
Diesel Inj. Pump Overhaul	.29	.25	.53	.50	.28	.32	2.17	.36
Diesel Inj. Pump Calibration	.24	.19	.55	.00	.38	.28	1.64	.27
Electronic Fuel Inj. Service	.06	1.16	.27	.25	.54	.28	2.56	.43
Electrical Lighting T-Shooting	2.53	1.84	2.53	2.75	2.61	1.29	13.55	2.26
Elec. Start & Charge T-Shoot	2.53	1.78	2.62	3.00	1.52	1.68	13.13	2.19
Electrical Ignition T-Shooting	2.12	1.50	1.79	2.25	1.73	1.17	10.56	1.76
Elec. Computer Control T-Shoot	.35	1.66	.79	.75	.73	.75	5.03	.84
Gen./Alternator Rebuild	1.29	.78	.91	1.75	.36	.61	5.70	.95
Starter Rebuild	1.18	.72	.94	1.25	.34	.35	4.78	.80
Electronic Ignition Systems	.76	1.41	.89	.75	1.06	.70	5.57	.93
Ignition Sys. Scope Analysis	.06	1.06	.30	.00	.42	.35	2.19	.37
Hydraulics T-Shooting	2.41	.94	2.68	2.50	1.41	1.61	11.55	1.93
Hydraulics Component Rebuild	2.18	.56	2.51	2.50	.86	1.26	9.87	1.65
Manual Transmission Rebuild	1.71	.69	1.43	.50	1.12	.48	5.93	.99
Automatic/P.S. Trans. T-Shoot	1.53	.81	1.70	.75	.78	.75	6.32	1.05
Automatic/P.S. Trans. Rebuild	1.19	.47	1.37	.50	.35	.69	4.57	.76
Hydrostatic Trans. T-Shoot	1.53	.16	1.57	1.00	.43	.65	5.34	.89
Hydrostatic Trans. Rebuild	.82	.13	1.00	.75	.23	.43	3.36	.56
Suspension Sys. Alignment	.53	1.22	.57	1.75	1.61	.61	6.29	1.05
Suspension Sys. Rebuild	.59	1.19	.94	2.00	1.85	.70	7.27	1.21
Front Axle Rebuild	.88	.81	1.15	1.25	1.58	.74	6.41	1.07
Pin & Bush Track Systems	.29	.09	1.26	1.75	.30	.35	4.04	.67
TOTALS (SUM)	45.70	32.51	47.55	44.50	38.56	26.60	235.42	39.28
TOTALS (AVG)	1.24	.88	1.29	1.20	1.04	.72	6.36	1.06

APPENDIX XXXVI
INDUSTRY FIT TO SURVEY TASK INVENTORY
(WITH ADDITIONAL DEGREES)

TASKS	AG	AUTO	CONST.	FORESTRY	TRUCK	OTHER	SUM	AVG
Air Brakes T-Shooting	1.00	.42	1.18	2.00	2.09	.75	7.44	1.24
Hydraulic Brakes T-Shooting	1.33	1.38	1.27	2.00	1.29	.75	8.02	1.34
Rebuild Major Brake Components	1.33	.80	1.36	1.50	1.70	.60	7.29	1.22
Turn Brake Drums or Rotors	.66	1.15	.50	.00	.67	.30	3.28	.55
A/C Sys T-Shooting	.50	1.34	.59	1.00	1.74	.30	5.47	.91
A/C Component Rebuild	.00	.67	.36	.50	.67	.15	2.35	.39
Diesel Engine Overhaul	2.00	.67	1.86	2.00	2.09	.85	9.47	1.58
Gasoline Engine Overhaul	1.66	1.35	1.47	2.00	1.06	.55	8.09	1.35
LP Gas Engine Overhaul	.00	.09	.50	.00	.41	.30	1.30	.22
Diff. Cone Point Setting	.00	.36	.85	1.00	.67	.25	3.13	.52
Rebuild Planetary Hubs	.66	.46	1.39	1.50	.46	.36	4.83	.81
Carbeuration Sys. T-Shooting	2.33	1.40	1.13	1.50	1.12	.80	8.28	1.38
Carbeurator Overhaul	2.00	1.14	.90	1.50	.90	.75	7.19	1.20
Diesel Inj. Sys. T-Shooting	1.66	.95	1.77	2.50	2.22	.95	10.05	1.68
Diesel Inj. Clean & Setting	.66	.58	1.36	2.00	1.19	.70	6.49	1.08
Diesel Inj. Pump Overhaul	.00	.32	.50	.00	.45	.40	1.67	.28
Diesel Inj. Pump Calibration	.00	.28	.68	.00	.54	.40	1.90	.32
Electronic Fuel Inj. Service	.00	1.53	.40	.50	.83	.45	3.71	.62
Electrical Lighting T-Shooting	2.33	1.51	1.68	3.00	2.48	1.35	12.35	2.06
Elec. Start & Charge T-Shoot	2.33	1.66	2.00	3.00	2.45	1.10	12.54	2.09
Electrical Ignition T-Shooting	2.00	1.71	1.54	2.00	1.64	1.05	9.94	1.66
Elec. Computer Control T-Shoot	1.00	1.68	1.13	2.00	1.16	.95	7.92	1.32
Gen./Alternator Rebuild	.66	.88	.63	1.50	.64	.70	5.01	.84
Starter Rebuild	.66	.74	.72	2.00	.48	.55	5.15	.86
Electronic Ignition Systems	.66	1.57	.77	1.50	1.06	.75	6.31	1.05
Ignition Sys. Scope Analysis	.33	1.20	.09	.50	.32	.03	2.47	.41
Hydraulics T-Shooting	1.66	.72	2.13	2.50	1.25	1.10	9.36	1.56
Hydraulics Component Rebuild	1.33	.48	1.78	2.50	.83	1.00	7.92	1.32
Manual Transmission Rebuild	.66	1.00	1.17	1.00	1.48	.70	6.01	1.00
Automatic/P.S. Trans. T-Shoot	.66	1.29	1.31	.50	1.22	.60	5.58	.93
Automatic/P.S. Trans. Rebuild	.66	.98	1.13	.00	.80	.40	3.97	.66
Hydrostatic Trans. T-Shoot	1.00	.27	1.00	1.25	.35	.65	4.52	.75
Hydrostatic Trans. Rebuild	.33	.22	.77	1.00	.38	.60	3.30	.55
Suspension Sys. Alignment	1.00	1.17	.63	.00	1.54	.45	4.79	.80
Suspension Sys. Rebuild	.00	1.00	.77	1.00	1.79	.40	4.96	.83
Front Axle Rebuild	1.00	.71	1.00	1.00	1.54	.40	5.65	.94
Pin & Bush Track Systems	.33	.24	1.63	1.00	.38	.30	3.88	.65
TOTALS (SUM)	34.39	33.92	39.95	48.75	41.89	22.69	221.59	36.97
TOTALS (AVG)	.93	.92	1.08	1.32	1.13	.61	5.99	1.00

APPENDIX XXXVII

ALPHA LISTING OF RECOMMENDED CHANGES

IN	BU	JO	A	TY	CHANGES
02	01	26	y	03	Advanced Degrees .... (Ferris needs to offer MBA)
05	01	18	y	03	AHM ...... (very few H.E. or Truck people respect AHM degree)
05	01	18	y	03	AHM .... (DISCOURAGE HES students from taking AHM)
05	01	30	y	03	AHM .... (Drop Algebra 2 and add Business Math)
03	23	05	y	03	AHM Program .... (more Data Prossesing Courses)
03	23	05	y	03	AHM Program .... (need more cost accounting)
02	02	08	y	03	AHM Program .... (highly recommended)
05	01	01	n		Air Conditioning
05	01	01	n		Air Conditioning
03	31	07	n		Air Conditioning
09	02	27	n		Air Conditioning
03	10	02	n		Air Conditioning
05	01	01	n		Air Conditioning
05	34	02	n		Air Conditioning
02	02	01	n		Air Conditioning
03	02	27	y	03	Air Conditioning & Heating Systems
01	10	22	n		Air Conditioning ...... (it's everywhere; ag, trucks & const)
05	01	01	n		Air Conditioning .... (must be taken by trucking students)
05	08	01	n		Air Conditioning .... (98% of our trucks are so equiped)
05	01	01	y	04	Air Conditioning .... (include a course on this subject)
05	07	01	n		Air Conditioning .... (should be included in curriculum)
05	10	01	n		Air Conditioning .... (75% of our fleet is so equipped)
05	07	01	y	01	Air Conditioning .... (should be a required course)
05	01	02	n		Air Conditioning .... (at least cover the basics)
05	08	02	n		Air Conditioning .... (needs to be included)
05	07	01	n		Air Conditioning .... (need to add)
05	30	01	n		Air Conditioning Service
05	10	28	n		Air Conditioning Service
05	31	07	n		Air Conditioning Service
05	07	03	n		Air Conditioning Service
02	01	02	n		Air Conditioning Service .... (soon to change due to EPA)
05	31	07	n		Air Conditioning Systems
05	01	01	n		Air Conditioning Systems
01	10	01	n		Air Conditioning Systems
03	01	13	n		Air Conditioning Systems
05	11	01	n		Air Conditioning Systems
05	08	01	n		Air Conditioning Systems .... (need to add)
01	01	01	n		Air Conditioning Systems .... (diagnosis)
02	02	04	y	03	Air Conditioning Systems .... (add)

APPENDIX XXXVII

ALPHA LISTING OF RECOMMENDED CHANGES

IN	BU	JO	A	TY	CHANGES
02	01	06	y	03	Air Conditioning Systems ... (add)
02	01	03	n		Automatic Transmissions
02	02	01	n		Automatic Transmissions
05	01	02	n		Automatic Transmissions . (trucks; at least service & adjust)
05	15	23	y	03	Automatic Transmissions ... (should be a req'd course)
03	30	01	n		Automatic Transmissions ... (we use many Allison's)
03	01	01	y	02	Automatic Transmissions ... (needs to be added)
01	10	01	n		Automatic Transmissions ... (need more of)
05	08	01	n		Automatic Transmissions ... (need to add)
03	01	01	n		Automatic Transmissions ... (rebuild)
05	11	01	n		Automatic Transmissions ... (busses)
05	11	01	n		Automatic Transmissions ... (busses)
05	08	01	n		Automatic Transmissions ... (truck)
17	43	01	n		Automatic Transmissions ... (truck)
05	07	01	n		Automatic Transmissions ... (truck)
03	02	27	y	03	Basic Machining Practices
02	34	02	y	01	Basic Shop Practices ... (a very IMPORTANT course)
02	02	08	y	03	Basic Shop Practices ... (very useful class)
01	01	03	n		Basic Shop Practices ... (EXCELLENT Class)
03	02	01	y	05	Blueprint Reading
03	02	27	y	03	Blueprint Reading
02	02	04	y	03	Blueprint Reading ... (engineering drawings)
05	08	01	y	01	Brake Systems ... (Anti-Lock; both air & hydraulic)
04	01	02	n		Brake Systems ... (spend more time on)
02	02	01	n		Brake Systems ... (anti-skid)
02	02	01	n		Brake Systems ... (hydraulic)
02	34	02	n		Brake Systems ... (basics)
05	01	01	y	01	Brake Systems ... (air)
02	02	01	n		Brake Systems ... (air)
01	31	01	n		Brakes & Suspensions
05	34	01	n		Brakes & Suspensions ... (too much auto, need MORE truck)
05	01	01	n		Brakes ... (cover in 5 wks, remainder on axle alignment)
05	30	01	n		Brakes ... (air; course was far below college level)
01	01	01	n		Brakes ... (less time on automotive hydraulic type)
05	07	01	n		Brakes ... (air; this area needs more attention!)
05	10	01	n		Brakes ... (air; include also all components)
05	08	01	n		Brakes ... (repairs on trailers and tractors)
30	01	01	y	07	Brakes ... (air; more hands-on experience)
02	01	26	y	03	Brakes ... (automotive; ABS system)

APPENDIX XXXVII

ALPHA LISTING OF RECOMMENDED CHANGES

IN	BU	JO	A	TY	CHANGES
02	01	06	y	03	Brakes .... (automotive; anti-lock)
02	02	04	y	03	Brakes .... (automotive; anti-lock)
05	11	01	n		Brakes .... (air; for busses)
16	02	27	y	03	Cogeneration .... (Information only)
02	02	05	y	03	Comebacks
02	01	18	y	03	Communication Skills
02	02	26	y	03	Communication Skills .... (oral & Written)
02	02	05	y	03	Communications
05	11	05	y	03	Communications .... (getting along with others)
02	01	05	y	03	Components ... (rebuilding major units is becoming very RARE)
09	02	27	n		Components .... (removal & installation on chassis)
05	31	07	n		Components .... (rebuilding; a thing of the PAST!)
02	31	07	y	01	Computer Controlled Fuel Systems
05	01	01	n		Computer Controlled Fuel Systems (diesel; CAT, Cummins, DDA)
05	07	01	n		Computer Controlled Fuel Systems .... (diesel; all mfg)
05	01	01	n		Computer Controlled Fuel Systems .... (diesel & gas)
05	34	01	n		Computer Controlled Fuel Systems .... (diesel)
05	31	01	n		Computer Controlled Fuel Systems .... (diesel)
05	03	08	y	04	Computer Controlled Fuel Systems .... (diesel)
05	01	01	n		Computer Controlled Fuel Systems .... (diesel)
05	10	01	n		Computer Controlled Fuel Systems .... (diesel)
02	01	26	y	03	Computer Controlled Fuel Systems .... (gas)
05	07	01	n		Computer Controlled Monitors & Sensors .. (shut-down systems)
05	31	07	n		Computer Controlled Monitors & Sensors .... (Kysor Sys)
05	07	01	n		Computer Controlled Monitors & Sensors.............. (trucks)
05	30	01	n		Computer Controlled Systems
19	02	32	y	01	Computer Controlled Systems
05	34	01	n		Computer Controlled Systems
02	03	01	y	02	Computer Controlled Systems
05	11	01	n		Computer Controlled Systems & Components
19	06	05	y	03	Computer Controlled Systems & Components
01	01	03	n		Computer Controlled Systems & Components
05	03	08	y	04	Computer Controlled Systems ...... (automatic trans; Allison)
02	01	01	n		Computer Controlled Systems .... (diesel & const. equip)
02	01	01	y	01	Computer Controlled Systems .... (electronic controls)
02	02	01	n		Computer Controlled Systems .... (electrical systems)
03	02	01	y	05	Computer Controlled Systems .... (electronic systems)
05	03	08	y	04	Computer controlled Systems .... (air brake systems)
05	01	30	y	03	Computer Controlled Systems .... (vehicle on board)

APPENDIX XXXVII

ALPHA LISTING OF RECOMMENDED CHANGES

IN	BU	JO	A	TY	CHANGES
05	07	01	n		Computer Controlled Systems .... (in general)
02	01	26	y	03	Computers .... (now to use service information systems)
05	01	18	y	03	Computers .... (software usage; more MS-DOS experience)
02	20	10	y	03	Computers .... (use of PC's with various software pkg)
05	08	01	n		Computers .... (classes; to become familar with CRT)
02	02	04	y	05	Computers .... (diagnosis equip. & data management)
02	02	04	y	03	Computers .... (classes; would be very benefical)
05	08	02	n		Computers .... (classes; needs to be included)
15	02	27	y	06	Computers .... (use of personal computers)
02	01	05	n		Computers .... (class on CRT operations)
05	08	02	n		Computers .... (basic terminal usage)
02	02	26	y	03	Computers .... (word prossesing)
01	09	06	y	07	Computers .... (basic skills)
06	30	01	n		Computers .... (basic skills)
02	03	08	y	02	Computers .... (basic skills)
02	01	18	y	03	Computers .... (knowledge)
02	01	06	y	03	Computers .... (cis\cise)
03	10	02	n		Computers .... (classes)
02	02	26	y	03	Course ...(Structure of Retail; auto sales, parts, & service)
02	02	26	y	03	Course . (Structure of Manufacturers; auto sales,parts,serv.)
02	02	05	y	05	Course ..... (add; electrical course for additional hands-on)
02	02	04	y	03	Course .... (Stress Management; should be part of program)
02	01	03	n		Course .... (add; a diagnostic or troubleshooting course)
02	02	04	y	03	Course .... (add; class to outline serv & sales rep jobs)
10	10	01	y	05	Course .... (add; Fundamentals of Systematic Tbshooting)
05	10	01	n		Course .... (parts; crossing brg to brg & seal to seal)
02	02	04	y	03	Course .... (with perferencing cars & warranty history)
05	01	02	n		Course .... (offer a class on DOT specs & regulations)
02	01	01	y	01	Course .... (need advanced electrical systems course)
06	30	01	n		Course .... (add; air compressor maintenance course)
03	01	18	n		Course .... (add; oil analysis & failure prediction)
10	10	01	y	05	Course .... (add; Fundamentals of Computer Control)
05	31	07	n		Course .... (optional; Setting Up A Small Business)
10	10	01	y	05	Course .... (add; Micro Electronics in H.E.)
02	02	04	y	03	Course .... (add; insurance course)
02	08	01	n		Courses (teach basic principles; should never be compromised)
05	08	01	y	03	Courses (test questions should be essay from service manuals)
01	01	03	n		Courses .. (hands-on work was very good, the more the better)
02	34	02	y	01	Courses .. (please continue to teach theory, the KEY to diag)

APPENDIX XXXVII

ALPHA LISTING OF RECOMMENDED CHANGES

IN	BU	JO	A	TY	CHANGES
02	02	05	y	03	Courses ... (stress the importance of a good grade point ave)
05	01	01	n		Courses ... (stress the importance of good clean work habits)
02	01	03	y	03	Courses ..... (teach basics and relate to current technology)
05	08	01	y	03	Courses .... (demand higher grades for program completion)
05	01	01	n		Courses .... (curriculum needs more hands on experiences)
03	01	01	n		Courses .... (emphasize more off-road construction equip)
03	23	07	n		Courses .... (as many as possible,need a very wide base)
03	01	02	y	02	Courses .... (basic concepts & theory is very important)
01	10	22	n		Courses .... (encourage all to be involved in hands-on)
05	08	01	n		Courses .... (more emphasis on hands-on or internships)
02	02	04	y	03	Courses .... (stress that students get fully certified)
05	34	01	n		Courses .... (basics should be brief at the beginning)
05	01	01	y	01	Courses .... (LESS classroom & MORE hands-on training)
05	04	02	n		Courses .... (teach to diagnose problems by listening)
01	02	27	n		Courses .... (continue to emphasize basic principles)
02	02	29	y	07	Courses .... (strive to make education fun to learn)
05	04	03	y	03	Courses .... (continue to teach basic fundamentals)
05	01	01	n		Courses .... (stress importance of basic concepts)
02	02	08	y	03	Courses .... (all; stress clean & neat Shop Area)
03	01	02	y	02	Courses .... (stress good work habits & ethics)
10	10	01	y	05	Courses .... (Teach basic theory & principles)
05	01	01	y	01	Courses .... (you need to update your courses)
05	31	07	n		Courses .... (must teach theory of operation)
05	07	01	n		Courses .... (need more hands-on training)
03	02	04	y	05	Courses .... (keep teaching the basics)
05	34	02	y	03	Courses .... (keep updated)
05	07	01	n		Cruise Control Systems .... (trucks)
05	31	07	n		Cruise Control Systems .... (trucks)
05	04	02	n		Curriculum (too much automotive tng in HES program: USELESS!)
02	02	08	y	03	Curriculum .. (appearance of Technicians important for image)
02	02	05	y	01	Curriculum ..... (don't be dependent on local gravel company)
19	30	03	n		Curriculum ..... (TOLD,"I'm over qualified under experinced")
05	01	01	n		Curriculum ...... (divide into 3 parts; Ag, Trucks, or Const)
05	02	01	y	01	Curriculum ...... (split students into Ag, Trucks, or Const.)
01	02	27	n		Curriculum .... (tell students of opportunities out there)
02	01	03	n		Curriculum .... (designate Fuel Injection 1 to gas sys)
02	02	29	y	07	Curriculum .... (update equipment & keep up with times)
02	02	05	y	01	Curriculum .... (provide more school owned equipment)
09	23	29	n		Curriculum .... (lacked in the skills to land a job)

APPENDIX XXXVII

ALPHA LISTING OF RECOMMENDED CHANGES

IN	BU	JO	A	TY	CHANGES
19	30	03	n		Curriculum .... (sixth qtr should be co-op in field)
02	02	05	y	01	Curriculum .... (get rid of POLITICS in curriculum)
05	01	01	n		Curriculum .... (allow for selective flexibility)
05	06	01	n		Curriculum .... (keep teaching the fundamentals)
09	23	29	n		Curriculum .... (gave me the skills to do job)
03	01	01	y	02	Curriculum .... (should be 3 year course)
02	02	05	y	03	Customer Relations
02	02	04	y	03	Customer Relations .. (should be taught to handle complaints)
17	43	01	y	02	Customer Relations .... (public speaking fundamentals)
02	02	05	y	03	Customer Relations .... (negotiation skills)
02	02	26	y	03	Customer Relations Skills
02	01	05	y	03	Diagnose Problems .... (DO MORE and in much more depth)
05	08	02	n		Diagnosis .... (electronic engine controls; gas & diesel)
05	10	01	n		Diagnosis .... (how to test without schools fancy equip)
01	01	01	n		Diagnosis .... (need much more time spent in this area)
02	01	05	y	03	Diagnostic Equipment .. (computerized; how to diagnosis with)
05	01	01	n		Diagnostic Equipment ..... (electronic, Compu-Check; Cummins)
03	01	01	n		Diagnostic Equipment .... (computerized; should cover)
05	31	01	n		Diagnostic Equipment .... (computerized)
23	23	05	n		Diesel Engines
05	07	03	n		Diesel Engines .. (repair; give option,in-depth/specific mfg)
05	01	01	n		Diesel Engines ...... (rebuild; more work on popular engines)
05	01	18	y	03	Diesel Engines .... (component locations better covered)
05	01	02	n		Diesel Engines .... (need to update; yours are obsolete)
07	31	07	n		Diesel Engines .... (fuel & crankcase press.;pyrometer)
05	15	23	y	03	Diesel Engines .... (rebuild; at least 1 engine req'd)
05	31	07	n		Diesel Engines .... (variable step timing)
05	31	01	n		Diesel Engines .... (Shut-Down Systems)
07	31	07	n		Diesel Engines .... (turbo compounding)
02	02	01	n		Diesel Engines .... (rebuilding)
01	01	01	n		Diesel Engines .... (diagnosis)
02	02	53	y	07	Diesel Engines .... (tune-ups)
02	02	04	y	03	Driveability .... (simulate problems by bugging equip)
02	01	05	y	03	Driveability .... (automotive; transmissions)
02	01	05	y	03	Driveability .... (automotive; fuel systems)
19	30	01	n		Electrical ... (schematics; inform students not always right)
03	02	04	y	05	Electrical .... (schematic reading; cover different mfg.)
02	02	09	y	04	Electrical .... (diagnosis; on chassis with test equip.)
05	02	01	y	01	Electrical .... (set up a complete truck lighting sys.)

APPENDIX XXXVII

ALPHA LISTING OF RECOMMENDED CHANGES

IN	BU	JO	A	TY	CHANGES
02	01	05	y	03	Electrical .... (diagnosis; needs concentrated effort)
05	10	01	n		Electrical .... (Let students wire a lighting system)
05	01	01	y	04	Electrical .... (must develop more PRACTICAL courses)
05	08	01	n		Electrical .... (schematic diagrams; teach to read)
10	10	02	y	05	Electrical .... (require theory & troubleshooting)
02	02	04	y	03	Electrical .... (more emphysis on circuits)
04	01	01	n		Electrical .... (need more Hands-On)
01	01	03	y	01	Electrical .... (schematic reading)
02	02	05	y	03	Electrical .... (schematic reading)
19	30	01	n		Electrical .... (schematic reading)
02	02	05	y	03	Electrical .... (rectified motors)
02	02	04	y	05	Electrical .... (diagnosis)
23	23	05	n		Electrical Systems
03	01	01	n		Electrical Systems
01	31	01	n		Electrical Systems
05	07	01	n		Electrical Systems .... (not enough time spent on these)
03	02	01	y	05	Electrical Systems .... (must be able to follow prints)
01	01	01	n		Electrical Systems .... (spend less time on generators)
05	07	01	y	07	Electrical Systems .... (stress alternators & starters)
05	01	01	y	01	Electrical Systems .... (advanced, more hands-on!)
02	02	05	y	03	Electrical Systems .... (all should be STRESSED!)
05	01	01	y	01	Electrical Systems .... (basic, more hands-on!)
05	08	01	n		Electrical Systems .... (go into in more depth)
05	31	07	n		Electrical Systems .... (heater & air circuits)
05	08	01	n		Electrical Systems .... (need to teach BASICS!)
02	34	02	n		Electrical Systems .... (emphasize the BASICS)
02	02	08	y	03	Electrical Systems .... (needs to be expanded)
05	01	01	n		Electrical Systems .... (cover float systems)
05	07	01	n		Electrical Systems .... (digital dashboards)
03	02	01	y	05	Electrical Systems .... (high voltage D.C.)
02	02	53	y	07	Electrical Systems .... (lights & starters)
05	31	07	n		Electrical Systems .... (need more overall)
05	34	01	n		Electrical Systems .... (heavy duty truck)
03	02	01	y	05	Electrical Systems .... (120 volts A.C.)
02	02	04	y	03	Electrical Systems .... (more emphasis)
02	01	06	y	03	Electrical Systems .... (more emphasis)
03	43	01	n		Electrical Systems .... (more emphasis)
01	01	01	n		Electrical Systems .... (diagnosis)
03	02	01	y	05	Electrical Systems .... (3 phase)

APPENDIX XXXVII

ALPHA LISTING OF RECOMMENDED CHANGES

IN	BU	JO	A	TY	CHANGES
05	08	01	y	03	Electrical Systems .... (MORE!)
05	07	01	n		Electrical Systems .... (MORE)
01	09	06	y	07	Electrical Testing .... (spend more time using equipment)
17	43	01	y	02	Electronic Controls
05	01	01	n		Electronic Controls & Monitors
03	01	02	y	02	Electronic Controls & Monitors
05	08	01	n		Electronic Controls & Monitors .... (diesel; instrumentation)
02	02	10	n		Electronic Controls & Monitors .... (sensors & devices)
01	02	01	n		Electronic Controls .... (powershift Trans; Twin Disc)
01	02	01	n		Electronic Controls .... (hydraulics; John Deere)
02	04	07	y	05	Electronic Controls .... (diagnosis, NOT theory)
05	34	02	y	03	Electronic Engine Controls .... (diesel; on CAT & Cummins)
05	03	08	y	04	Electronic Engine Controls .... (DDEC, PACE, & PEEK sys)
05	01	01	y	01	Electronic Engine Controls .... (computerized; trucks)
05	31	07	n		Electronic Engine Controls .... (diesel; govenors)
05	08	02	y	03	Electronic Engine Controls .... (programmable)
01	10	03	n		Electronic Engine Controls .... (diesel)
03	01	01	n		Electronic Engine Controls .... (diesel)
05	07	01	n		Electronic Engine Controls .... (diesel)
15	01	02	n		Electronic Engine Controls .... (diesel)
05	08	01	n		Electronic Engine Controls .... (diesel)
02	02	09	y	04	Electronic Engine Controls .... (gas)
03	01	05	y	03	Electronic Fuel Injection .... (rebuild; CAT)
05	11	01	y	01	Electronic Fuel Injection .... (busses)
05	11	01	n		Electronic Fuel Injection .... (busses)
17	43	01	n		Electronic Fuel Injection .... (diesel)
01	01	01	n		Electronic Fuel Injection .... (diesel)
07	31	07	n		Electronic Fuel Injection .... (diesel)
05	31	07	n		Electronic Fuel Injection .... (diesel)
05	01	01	n		Electronic Fuel Injection .... (diesel)
31	01	41	n		Electronic Fuel Injection .... (diesel)
01	02	01	n		Electronic Fuel Injection .... (Bosch)
02	02	04	y	03	Electronic Fuel Injection .... (gas)
05	01	01	y	01	Electronic Fuel Injection Systems
05	34	01	n		Electronic Fuel Injection Systems
02	02	10	y	03	Electronic Fuel Injection Systems .... (gas; servicing)
15	02	27	y	06	Electronic Fuel Injector Diagnosis .... (diesel)
15	02	27	y	06	Electronic Fuel Injector Repair .... (diesel)
02	02	10	n		Electronic Fuel Injectors .... (gas; unit injectors)

APPENDIX XXXVII

ALPHA LISTING OF RECOMMENDED CHANGES

IN	BU	JO	A	TY	CHANGES
02	34	02	y	01	Electronic Fuel Systems
05	01	30	y	03	Electronic Fuel Systems .... (diesel; diagnosis & repair)
01	02	01	n		Electronic Fuel Systems .... (Detroit Diesel)
02	01	18	y	03	Electronic Fuel Systems .... (controls)
05	08	01	y	01	Electronic Fuel Systems .... (diesel)
05	01	01	n		Electronic Fuel Systems .... (diesel)
03	31	07	n		Electronic Fuel Systems .... (diesel)
03	06	01	n		Electronic Ignition Systems .... (gas)
01	02	27	n		Electronic Systems .... (whats in black-box NOT NEEDED)
03	43	01	n		Electronic Systems .... (theory & troubleshooting)
02	02	26	y	03	Electronic Systems .... (control)
02	31	07	y	01	Electronic Systems .... (general)
05	07	01	n		Electronics
02	01	01	n		Electronics
03	01	01	n		Electronics
05	01	01	n		Electronics
05	11	01	n		Electronics
02	01	01	n		Electronics
05	30	01	n		Electronics
05	11	01	n		Electronics
02	01	18	y	03	Electronics
02	02	04	y	03	Electronics
05	08	01	y	01	Electronics ..... (STRESS! everything is digital & computers)
03	01	01	y	01	Electronics .... (electrical over hydraulics & air sys.)
02	02	27	y	03	Electronics .... (digital signal analysis for PM sys.)
02	01	03	n		Electronics .... (more has to be done in this area!)
05	08	02	n		Electronics .... (more courses need to be included)
03	01	02	y	02	Electronics .... (good understanding of basics)
02	02	10	n		Electronics .... (more emphasis)
02	02	04	y	03	Electronics .... (more emphasis)
03	01	01	n		Electronics .... (emphasize)
02	02	01	n		Electronics .... (computer)
02	02	04	y	03	Electronics .... (basics)
02	01	03	y	03	Emissions .... (gas engines)
19	06	05	y	03	Emissions Course
02	34	02	n		Engines .. (fundamentals very important; emphasize DIAGNOSIS)
05	01	01	y	01	Engines .. (you MUST get your rebuild proceedures ORGANIZED!)
05	03	08	y	04	Engines .... (expand rebuilding; Cummins 855 & CAT 3406B)
30	01	05	n		Engines .... (rebuilding; small industrial)

APPENDIX XXXVII

ALPHA LISTING OF RECOMMENDED CHANGES

IN	BU	JO	A	TY	CHANGES
05	01	01	y	01	Engines ... (tune-up; setting V & I)
02	31	01	n		Engines ... (tune-up; need more)
05	01	01	y	01	Engines ... (cooling systems)
02	02	01	n		Engines ... (rebuilding; gas)
01	31	01	n		Engines ... (diesel & gas)
03	01	01	y	02	Engines ... (rebuilding)
03	02	27	y	03	English
03	23	06	y	01	Equipment Operation ... (basics)
05	02	01	n		Faculty ... (should be attending factory schools)
05	02	01	n		Faculty ... (are NOT keeping up with today!)
01	01	01	n		Failure Analysis
02	02	26	y	03	Failure Analysis
05	04	02	n		Failure Analysis
01	10	01	n		Failure Analysis ... (need more on engines)
05	08	01	n		Fifth Wheels ... (knowledge of)
05	07	01	n		Final Drives ... (drivetrain & engine angles are important!)
05	02	01	n		Final Drives ... (more emphasis on maint. & less on rebuild)
05	01	01	y	01	Final Drives ... (expand knowledge in steering clutch area)
05	07	01	n		Final Drives ... (tear down wastes time,it's a specialty)
02	34	02	n		Final Drives ... (only basics, NO rebuilding components)
05	01	01	y	01	Final Drives ... (cover more on inboard planetary sets)
05	02	01	n		Final Drives ... (eng & trans setup to demo clutch adj)
03	31	07	n		Final Drives ... (more crawler steering & final drives)
05	04	05	n		Final Drives ... (differentials; need more class time)
05	01	01	n		Final Drives ... (farm tractor drives; NONE taught!)
03	30	01	y	04	Final Drives ... (clutch work; need more hands-on)
05	08	02	y	03	Final Drives ... (need to include power dividers)
05	01	01	n		Final Drives ... (On-Job-Training was lacking)
05	10	01	n		Final Drives ... (differentials)
05	10	01	n		Final Drives ... (clutches)
05	08	01	n		First Aid ... (should be a requirement)
05	34	02	n		Front end Alignment (truck; front & rear axles; conv & lazer)
01	31	01	n		Fuel Injection
01	09	06	y	07	Fuel Injection ... (pump & injectors; MORE diag,LESS repair)
03	30	01	n		Fuel Injection ... (pump & injector repair; LESS Time on)
05	01	01	n		Fuel Injection ... (class was good,need more tbshooting)
02	01	03	n		Fuel Injection ... (gas; more emphasis on port & T-body)
05	10	28	n		Fuel Injection ... (pump & injector rebuild; NOT NEEDED)
05	01	18	y	03	Fuel Injection ... (Delete Rebuilding! R & R in field)

APPENDIX XXXVII

ALPHA LISTING OF RECOMMENDED CHANGES

IN	BU	JO	A	TY	CHANGES
03	01	01	n		Fuel Injection .... (too much time spent in this area!)
05	07	01	n		Fuel Injection .... (diesel, should cover more)
05	01	01	y	01	Fuel Injection .... (needs to be updated)
05	04	05	n		Fuel Injection .... (Big Business)
05	01	01	n		Fuel Injection .... (we need LESS)
05	01	01	y	01	Fuel Injectors .... (STC Injectors)
02	02	01	n		Fuel Systems
03	01	01	n		Fuel Systems
02	34	02	n		Fuel Systems .... (keep BASIC, dont't need overhaul)
05	31	01	n		Fuel Systems .... (diesel; Mack Truck)
30	01	05	n		Fuel Systems .... (L.P. gas systems)
05	31	07	n		Fuel Systems .... (L.P. gas systems)
30	01	03	n		Fuel Systems .... (L.P. gas systems)
03	31	07	n		Fuel Systems .... (gas carburation)
05	01	01	n		Fuel Systems .... (theory)
03	10	01	n		Generator Sets .... (basic knowledge would be helpful)
05	01	30	y	03	Generator Sets .... (troubleshooting & repair)
03	02	04	y	03	Ground Engaging Tools
32	32	05	n		Hydraulics
23	23	05	n		Hydraulics
01	31	01	n		Hydraulics
03	01	01	n		Hydraulics
05	02	01	y	01	Hydraulics ..... (set up a complete sys with fittings & hose)
05	30	01	y	02	Hydraulics .... (a key area, advancements are unbelieving)
05	01	01	n		Hydraulics .... (should be an elective for truck student)
03	01	01	n		Hydraulics .... (curriculum should have more hydraulics)
05	10	03	y	03	Hydraulics .... (needs more hands-on problem situations)
01	01	01	n		Hydraulics .... (need more on electrically controlled)
03	01	01	n		Hydraulics .... (need much more time in this area)
02	02	08	y	03	Hydraulics .... (basics was a very useful class)
03	31	07	n		Hydraulics .... (more electric over hydraulics)
03	01	01	y	01	Hydraulics .... (more would have been helpful)
05	04	05	n		Hydraulics .... (cylinders, pumps, & valves)
17	43	01	y	02	Hydraulics .... (electronically controlled)
05	01	01	y	01	Hydraulics .... (solenoid activated valves)
03	01	01	n		Hydraulics .... (load sensing systems)
05	11	01	n		Hydraulics .... (basic understanding)
05	02	01	y	01	Hydraulics .... (include hose making)
05	01	01	n		Hydraulics .... (not stressed enough)

APPENDIX XXXVII

ALPHA LISTING OF RECOMMENDED CHANGES

IN	BU	JO	A	TY	CHANGES
04	01	01	n		Hydraulics .... (need more Hands-On)
03	02	04	y	03	Hydraulics .... (increase training)
01	01	03	y	01	Hydraulics .... (schematic reading)
19	30	01	n		Hydraulics .... (schematic reading)
03	01	01	n		Hydraulics .... (excavator repair)
01	01	01	n		Hydraulics .... (diagnosis)
01	01	03	n		Hydraulics .... (need more)
03	01	01	n		Hydraulics .... (need more)
02	34	02	n		Hydraulics .... (basics)
03	01	01	n		Hydrostatic Transmissions
02	03	01	y	02	Hydrostatic Transmissions
03	01	03	y	03	Hydrostatic Transmissions
32	32	05	n		Hydrostatic Transmissions
03	02	04	y	03	Hydrostatic Transmissions
03	30	01	n		Hydrostatic Transmissions .... (need more in the classes)
03	01	01	n		Hydrostatic Transmissions .... (operation of various sys)
03	01	01	y	02	Hydrostatic Transmissions .... (need hands-on)
01	01	01	n		Hydrostatic Transmissions .... (diagnosis)
01	01	03	n		Hydrostatic Transmissions .... (need more)
03	01	05	y	03	Hydrostatic Transmissions .... (rebuild)
03	01	01	n		Hydrostatic Transmissions .... (repair)
03	02	01	y	05	Industrial Burner Skills
05	07	01	n		Industrial Psychology
09	23	29	n		Job Placement .... (follow up on college's part was POOR)
09	02	41	n		Job Placement .... (needs to be improved)
05	01	01	n		Job Placement .... (is very POOR)
05	04	02	n		Maintenance .... (NOT enough emphasis on basics)
05	01	01	y	01	Maintenance .... (field)
03	02	27	y	03	Management .... (labor relations; discipline & grievances)
02	02	08	y	03	Management .... (time management; needs to be stressed)
02	02	26	y	03	Management .... (organizational skills)
02	34	02	n		Management .... (basic)
03	02	27	y	03	Manufacturing Processes .... (time-studies)
03	02	01	y	05	Material Handling .... (conveyor systems, etc.)
07	01	03	n		Math ..... (shop or business math; need to use formulas more)
03	01	01	y	02	Math .... (general math should be emphasized)
03	02	01	y	05	Math .... (MUST have a good background)
01	01	03	n		Math .... (more advanced would help)
01	09	06	y	07	Math .... (business)

APPENDIX XXXVII

ALPHA LISTING OF RECOMMENDED CHANGES

IN	BU	JO	A	TY	CHANGES
02	01	18	y	03	Math Skills
02	02	04	y	03	New Product Information To Students .... (need to update)
02	36	05	y	03	Opportunities ... (inform students; Tech. writing & teaching)
04	10	01	n		Painting .... (basic practices)
05	10	28	n		Parts Department Training .... (only lightly covered)
03	30	01	y	04	Parts Identification .... (need more work in this area)
03	02	04	y	03	Parts Inventory Control
03	01	01	y	02	Paving Equipment Familiarization .... (big business now)
05	08	01	y	03	Penmanship .... (STRESS! R.O.'s must be legible)
02	01	18	y	03	Physics .... (basic)
03	01	01	n		Powershift Transmissions
03	01	01	n		Powershift Transmissions
03	01	01	n		Powershift Transmissions
03	01	01	n		Powershift Transmissions .... (need to add to curriculum)
03	01	01	n		Powershift Transmissions .... (MORE! Clark,Funk,& MF)
03	01	01	n		Powershift Transmissions .... (in great detail!)
01	10	01	n		Powershift Transmissions .... (need more of)
03	01	05	y	03	Powershift Transmissions .... (rebuilding)
03	01	01	n		Powershift Transmissions .... (repair)
03	02	04	y	03	Powershift Transmissions .... (more)
02	02	01	n		Preventive Maintenance
05	02	01	n		Preventive Maintenance .... (DO hands-on, NOT just paperwork)
05	07	01	y	07	Preventive Maintenance .... (spend more time showing how)
05	03	08	y	04	Preventive Maintenance .... (hands-on, what to look for)
05	15	23	y	03	Preventive Maintenance .... (theorys of PM & inspection)
05	11	05	y	03	Preventive Maintenance .... (teach how to set up)
03	30	01	y	04	Preventive Maintenance .... (need more training)
04	01	02	n		Preventive Maintenance .... (spend more time on)
02	02	04	y	03	Reading Parts Catalogs
05	08	01	y	03	Reading Service Manuals .... (emphasize the importance)
02	02	26	y	03	Reading Skills
03	06	01	n		Rigging .... (cables; lifting & maintenance)
19	02	32	y	01	Rigging .... (with emphasis on safety)
03	02	01	y	05	Rigging Skills .... (erecting 50 ton units W/gear boxes)
03	01	01	y	02	Rigging,Slinging,Jacking,& Cribbing Skills .... (DEMO's)
03	02	01	y	05	Safety
19	02	32	y	01	Safety .... (should be stressed much more in curriculum)
05	30	01	y	02	Screen Students By Mechanical Abilities
05	06	01	n		Seminars .... (offer 1 or 2 day sessions on new tech)

APPENDIX XXXVII

ALPHA LISTING OF RECOMMENDED CHANGES

IN	BU	JO	A	TY	CHANGES
02	02	08	y	03	Service Floor (quick repairs must be stressed for flat rate)
05	04	02	n		Service Floor .... (need structured tng. LESS HIT & MISS)
05	01	01	n		Service Floor .... (PLEASE! make training more realistic)
05	31	07	n		Service Floor .... (should be geared more towards trucks)
19	30	01	n		Service Floor .... (make students do 1 job in flat rate)
05	04	02	n		Service Floor .... (practice more basic troubleshooting)
07	02	01	y	01	Service Floor .... (must make students to work faster!)
05	10	28	n		Service Floor .... (more H.E.; NOT cars & lawn Mowers)
05	04	02	n		Service Floor .... (too much overview & wasted Time)
05	10	28	n		Service Floor .... (more Hands-on troubleshooting)
02	01	05	y	03	Service Manuals .... (teach how to use them to save time)
05	04	05	n		Steering Systems ..... (power; an excellent growing business)
05	34	01	n		Steering Systems .... (heavy duty truck)
05	01	01	n		Steering Systems .... (power)
02	01	06	y	03	Supplimental Restraint Systems
02	02	01	n		Suspension Systems
01	01	01	n		Suspension Systems .(air systems; more on operation & theory)
05	02	01	n		Suspension Systems ..... (air systems; explain how they work)
05	10	01	n		Suspension Systems .... (class specializing on this area)
05	34	01	n		Suspension Systems .... (truck; H.D. operation & rebuild)
01	01	01	n		Suspension Systems .... (more on component replacement)
04	01	02	n		Suspension Systems .... (spend more time on)
02	02	53	y	07	Suspension Systems .... (trucks; rebuilding)
05	07	01	n		Suspensions & Brakes (wheel seals; cover removal & replacing)
30	01	01	y	07	Suspensions & Brakes ... (more wheel bearings & axle changes)
05	10	03	y	03	Suspensions & Brakes .... (add relation of tires to axle)
05	10	03	y	03	Suspensions & Brakes .... (must add truck disc brakes)
09	02	27	n		Tire Handling
05	08	01	n		Tire Maintenance
04	01	02	n		Tire Maintenance & Repair
05	08	01	n		Tire Maintenance & Repair
05	07	01	n		Tires .... (a couple of days, especially SAFETY)
05	01	01	y	01	Tires .... (Beads & split Rings)
02	02	04	y	03	Tool Identification .... (should be decreased)
05	01	01	y	01	Tracks & Undercarriage Systems .... (expand in this area)
03	01	03	y	03	Tracks & Undercarriage Systems .... (more emphasis)
03	01	28	y	01	Tracks & Undercarriage Systems .... (need to add)
02	02	30	y	05	Tractor Trailers .. (suspensions systems; Air Ride, M-Z, T-Z)
05	01	01	n		Tractor Trailers .... (teach axle alignment,MAJOR CONCERN)

APPENDIX XXXVII

ALPHA LISTING OF RECOMMENDED CHANGES

IN	BU	JO	A	TY	CHANGES
02	02	30	y	05	Tractor Trailers .... (curriculum needs to cover repairs)
05	01	01	n		Tractor Trailers .... (maintenance; you teach NONE!)
05	01	01	n		Tractor Trailers .... (need to cover tankers)
03	01	01	n		Transmissions .... (we need more than just Fuller!)
01	02	27	n		Transmissions .... (hydraulic Controlled Systems)
05	04	05	n		Transmissions .... (need more class time)
03	01	01	n		Transmissions .... (tractor-scraper)
05	10	01	n		Transmissions .... (manual)
03	01	03	y	03	Transmissions .... (HLR)
05	31	07	n		Transport Refrigeration
09	02	27	n		Transport Refrigeration
05	01	01	n		Transport Refrigeration .... (should be in curriculum)
05	08	02	n		Transport Refrigeration .... (needs to be included)
05	10	01	n		Transport Refrigeration .... (add to curriculum)
05	01	01	n		Transport Refrigeration .... (we offer NONE!)
05	30	01	n		Transport Refrigeration Service
05	10	01	n		Transport Refrigeration Service
05	07	01	n		Trip Recorders .... (interface with micro-computer)
02	03	08	y	02	Troubleshooting
02	02	26	y	03	Troubleshooting
30	01	03	n		Troubleshooting & Diagnosis .... (emphasize speed)
05	07	03	n		Troubleshooting .... (diesel engine, in-depth for mfg.option)
05	31	07	n		Troubleshooting .... (all systems; To find bad components)
01	01	01	n		Troubleshooting .... (air brakes; need more in this area)
05	01	01	n		Troubleshooting .... (electronic & computerized fuel sys)
02	04	07	y	05	Troubleshooting .... (electronic computer controlled sys)
01	01	01	n		Troubleshooting .... (electrical,need LOTS & LOTS of it)
26	02	04	y	03	Troubleshooting .... (more concentrated effort to teach)
03	30	01	n		Troubleshooting .... (more hands-on in electrical & hyd)
03	10	02	n		Troubleshooting .... (classes on engines & electrical)
30	01	03	n		Troubleshooting .... (electrical; CONCENTRATE on this)
03	01	01	n		Troubleshooting .... (hydraulics; cover more in depth)
05	01	01	n		Troubleshooting .... (electrical, Set Up Tbshoot Lab)
05	10	03	y	03	Troubleshooting .... (electrical,needs more emphasis)
06	30	01	n		Troubleshooting .... (electrical; need more hands-on)
03	01	05	y	03	Troubleshooting .... (electronic fuel injection, CAT)
10	10	02	y	05	Troubleshooting .... (hydraulics; need MORE classes!)
05	10	01	n		Troubleshooting .... (electrical; more concentrated)
03	01	02	y	02	Troubleshooting .... (electronics, this is CRITICAL)

APPENDIX XXXVII

ALPHA LISTING OF RECOMMENDED CHANGES

IN	BU	JO	A	TY	CHANGES
03	01	02	y	02	Troubleshooting .... (hydraulics; more if possible)
05	08	02	y	03	Troubleshooting .... (charging & starting systems)
01	01	03	y	01	Troubleshooting .... (electronic printed circuits)
03	01	01	n		Troubleshooting .... (excavator hydraulic systems)
03	01	01	n		Troubleshooting .... (Computer Controled Systems)
02	02	08	y	03	Troubleshooting .... (speed needs to be stressed)
05	07	01	y	07	Troubleshooting .... (engines, stress much more)
03	01	01	n		Troubleshooting .... (hydrostatic transmissions)
05	08	01	n		Troubleshooting .... (air conditioning systems)
03	01	01	n		Troubleshooting .... (powershift transmissions)
05	08	02	y	03	Troubleshooting .... (these skills are a MUST!)
05	08	02	y	03	Troubleshooting .... (fuel injection systems)
05	10	03	y	03	Troubleshooting .... (hydraulics, needs more)
03	02	04	y	03	Troubleshooting .... (need more in all areas)
02	31	01	n		Troubleshooting .... (electrical, need more)
05	34	02	y	03	Troubleshooting .... (electrical; need more)
05	01	01	y	04	Troubleshooting .... (electrical diagnosis)
02	02	01	n		Troubleshooting .... (diesel & gas engine)
05	08	01	n		Troubleshooting .... (electrical systems)
02	02	01	n		Troubleshooting .... (electrical systems)
02	01	05	y	03	Troubleshooting .... (electrical systems)
04	10	02	y	03	Troubleshooting .... (electrical systems)
03	01	05	y	03	Troubleshooting .... (hydrostatic drives)
01	01	01	n		Troubleshooting .... (spend more time on)
05	34	02	y	03	Troubleshooting .... (brakes; need more)
05	34	02	y	03	Troubleshooting .... (engines need more)
05	01	01	n		Troubleshooting .... (glow plug systems)
05	08	02	y	03	Troubleshooting .... (heavy duty drives)
07	31	07	n		Troubleshooting .... (advanced methods)
05	08	01	n		Troubleshooting .... (air conditioning)
05	10	28	n		Troubleshooting .... (air conditioning)
02	31	01	n		Troubleshooting .... (engine problems)
03	01	01	n		Troubleshooting .... (diesel engine)
03	01	01	n		Troubleshooting .... (more over all)
05	01	01	y	01	Troubleshooting .... (fuel systems)
05	01	01	y	01	Troubleshooting .... (air brakes)
05	08	02	y	03	Troubleshooting .... (air brakes)
02	02	10	n		Troubleshooting .... (Electrical)
01	10	03	n		Troubleshooting .... (electrical)

APPENDIX XXXVII

ALPHA LISTING OF RECOMMENDED CHANGES

IN	BU	JO	A	TY	CHANGES
05	08	01	n		Troubleshooting .... (electrical)
05	08	01	n		Troubleshooting .... (electrical)
01	01	03	n		Troubleshooting .... (electrical)
05	07	01	n		Troubleshooting .... (electrical)
05	02	01	y	01	Troubleshooting .... (electrical)
03	43	01	n		Troubleshooting .... (hydraulics)
02	02	01	n		Troubleshooting .... (hydraulics)
01	01	03	n		Troubleshooting .... (hydraulic)
05	07	01	n		Troubleshooting .... (brakes)
05	34	02	n		Truck Frame Work .... (repairing broken & cracked frames)
28	32	05	n		Turf Cutting Equipment .... (grinding reels & knives)
02	02	26	y	03	Typing
03	02	27	y	03	Typing .... (50 wpm for computer use)
02	01	05	n		Typing .... (should be mandatory)
02	02	26	y	03	Warranty Policies & Procedures
10	10	01	y	05	Welding & Fabrication .. (IMPORTANT! include in with welding)
03	10	02	n		Welding & Fabrication .... (should add more classes)
05	01	01	n		Welding .... (possibly cover aluminum welding)

APPENDIX XXXVIII

GRADUATES' RECOMMENDATIONS ON COURSES AND CURRICULUM

Subject	Total Number	Without Add'l Degrees Number	With Add'l Degrees Number
Troubleshooting	69	40	29
Electrical	46	21	25
Air Conditioning	33	28	5
Courses (Comments on)	30	14	16
Hydraulics	30	20	10
Electronics	25	14	10
Brakes	20	14	6
Computers	17	6	11
Courses (Add)	17	6	11
Curriculum (Comments on)	17	10	7
Computer Controlled Systems	15	7	8
Final Drives	15	11	4
Automatic Transmissions	14	12	2
Electronic Fuel Injection	14	9	5
Diesel Engines	13	10	3
Fuel Injection	13	9	3
Hydrostatic Transmissions	13	7	5
Suspension Systems	13	8	4
Electronic Engine Controls	11	6	5
Computer Controlled Fuel Systems	10	7	3
Engines	10	5	5
Powershift Transmissions	10	8	2
Service Floor	10	8	2
Fuel Systems	9	9	-
Electronic Controls and Monitors	8	5	3
Preventive Maintenance	8	3	5
Transport Refrigeration	8	8	-
Electronic Fuel Controls	7	3	4
AHM (AHT)	6	-	6
Mathematics	6	2	4
Tire Maintenance	6	5	1
Transmissions	6	5	1
Customer Relations	5	-	5
Tractor Trailers	5	3	2

APPENDIX XXXVIII - CONTINUED

GRADUATES' RECOMMENDATIONS ON COURSES AND CURRICULUM

Subject	Total Number	Without Add'l Degrees Number	With Add'l Degrees Number
Communications	4	-	4
Diagnosis	4	3	1
Diagnostic Equipment	4	3	1
Failure Analysis	4	3	1
Management	4	1	3
Rigging	4	1	3
Basic Shop Practices	3	1	2
Blueprint Reading	3	-	3
Components	3	2	1
Computer Monitors and Sensors	3	3	-
Driveability	3	-	3
Electronic Fuel Injectors	3	1	2
Job Placement	3	3	-
Parts	3	1	2
Reading Skills	3	-	3
Steering Systems	3	3	-
Tracks and Undercarriages	3	-	3
Typing	3	1	2
Welding and Fabrication	3	2	1

*This table contains only the data with frequencies of three or more respondents per total category.

APPENDIX XXXIX

TRUCKING INDUSTRY GRADUATES' RECOMMENDATIONS ON COURSES & CURRICULUM

Subject	Total Number	Without Add'l Degrees Number	With Add'l Degrees Number
AHM (AHT)	3	-	3
Air Conditioning	21	19	2
Automatic Transmissions	7	6	1
Brakes	9	7	2
Communications	1	-	1
Components	1	1	-
Computer Controlled Fuel Sys.	8	7	1
Computer Monitors & Sensors	3	3	-
Computer Controlled Systems	7	4	3
Computers	4	3	1
Courses (Add)	3	3	-
Courses (Comments on)	14	8	6
Curriculum (Comments on)	5	4	1
Diagnosis	2	2	-
Diagnostic Equipment	2	2	-
Diesel Engines	7	5	2
Electrical	17	11	6
Electronic Controls & Monitors	2	2	-
Electronic Engine Controls	7	3	4
Electronic Fuel Injection	6	4	2
Electronic Fuel Systems	3	1	2
Electronics	7	6	1
Engines	4	-	4
Failure Analysis	1	1	-
Final Drives	12	9	3
Fuel Injection	7	5	2
Fuel Systems	3	3	-
Hydraulics	9	4	5
Job Placement	1	1	-
Parts	1	1	-
Preventive Maintenance	5	1	4
Reading Skills	1	-	1
Service Floor	7	7	-
Steering Systems	3	3	-
Suspension Systems	6	4	2
Tire Maintenance	4	3	1
Tracks & Undercarriage	1	-	1
Tractor Trailers	3	3	-
Transmissions	2	2	-
Transport Refrigeration	7	7	-
Troubleshooting	29	14	15
Welding & Fabrication	1	1	-

APPENDIX XXXX

AUTOMOTIVE INDUSTRY GRADUATES' RECOMMENDATIONS ON COURSES AND CURRICULUM

Subject	Total Number	Without Add'l Degrees Number	With Add'l Degrees Number
AHM (AHT)	1	-	1
Air Conditioning	4	2	2
Automatic Transmissions	2	2	-
Basic Shop Practices	2	-	2
Blueprint Reading	1	-	1
Brakes	7	4	3
Communications	3	-	3
Components	1	-	1
Computer Controlled Fuel Sys.	2	-	2
Computer Controlled Systems	4	2	2
Computers	9	1	8
Courses (Add)	9	1	8
Courses (Comments on)	7	1	6
Curriculum (Comments on)	6	1	5
Customer Relations	4	-	4
Diagnosis	1	-	1
Diagnostic Equipment	1	-	1
Diesel Engines	2	1	1
Driveability	3	-	3
Electrical	12	1	11
Electronic Controls	2	1	1
Electronic Engine Controls	1	-	1
Electronic Fuel Injection	2	-	2
Electronic Fuel Injectors	1	1	-
Electronic Fuel Systems	2	-	2
Electronics	12	5	7
Engines	3	3	-
Failure Analysis	1	-	1
Final Drives	1	1	-
Fuel Injection	1	1	-
Fuel Systems	2	2	-
Hydraulics	2	1	1
Hydrostatic Transmissions	1	-	1
Management	3	1	2
Mathematics	1	-	1
Preventive Maintenance	1	1	-
Reading Skills	2	-	2
Service Floor	1	1	1
Suspension Systems	2	-	1
Tractor Trailers	2	1	2
Troubleshooting	11	6	5
Typing	2	1	1

APPENDIX XXXXI

CONSTRUCTION INDUSTRY GRADUATES' RECOMMENDATIONS ON COURSES AND CURRICULUM

Subject	Total Number	Without Add'l Degrees Number	With Add'l Degrees Number
AHM (AHT)	2	-	2
Air Conditioning	4	3	1
Automatic Transmissions	3	2	1
Blueprint Reading	2	-	2
Computer Controlled Systems	1	-	1
Computers	1	1	-
Courses (Add)	1	1	-
Courses (Comments on)	5	2	3
Curriculum (Comments on)	1	-	1
Diagnostic Equipment	1	1	-
Electrical	7	2	5
Electronic Controls & Monitors	1	-	1
Electronic Engine Controls	1	1	-
Electronic Fuel Injection	1	-	1
Electronic Fuel Systems	1	1	-
Electronics	5	3	2
Engines	1	-	1
Final Drives	2	1	1
Fuel Injection	2	2	-
Fuel Systems	2	2	-
Hydraulics	9	7	2
Hydrostatic Transmissions	8	4	4
Management	1	-	1
Mathematics	2	-	2
Parts	3	1	2
Powershift Transmissions	9	7	2
Preventive Maintenance	1	-	1
Rigging	3	1	2
Tracks & Undercarriage	2	-	2
Transmissions	3	2	1
Troubleshooting	15	10	5
Typing	1	-	1
Welding & Fabrication	1	1	-

APPENDIX XXXXII

Agriculture and Forestry Industry Graduates' Recommendations on Courses and Curriculum

Agriculture

	Total	Without Add'l Degrees	With Add'l Degrees
Air Conditioning	3	3	-
Automatic Transmissions	1	1	-
Basic Shop Practices	1	1	-
Brakes	2	2	-
Computer Controlled Sys	1	1	-
Computers	1	-	1
Courses (Comments on)	3	3	-
Curriculum (Comments on)	1	1	-
Diagnosis	1	1	-
Diesel Engines	1	1	-
Electrical	5	3	2
Elec. Controls & Monitors	2	2	-
Electronic Engine Controls	1	1	-
Electronic Fuel Injection	2	2	-
Electronis Fuel Systems	1	1	-
Electronics	1	1	-
Engines	1	1	-
Failure Analysis	2	2	-
Fuel Injection	2	1	1
Hydraulics	5	4	1
Hydrostatic Trans.	2	2	-
Mathematics	2	1	1
Powershift Transmissions	1	1	-
Suspension Systems	2	2	-
Transmissions	1	1	-
Troubleshooting	7	6	1

Forestry

	Total	Without Add'l Degrees	With Add'l Degrees
Brakes	1	1	-
Electrical	1	1	-
Hydraulics	1	1	-
Preventive Maint.	1	1	-
Suspension Systems	1	1	-
Tire Maintenance	1	1	-

Heavy Equipment Technology,
Heavy Equipment Service Engineering Technology

APRC 1998-1999

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COMMENTS BY GRADUATES WITHOUT ADDITIONAL DEGREES

In	Bu	Jo	Comments
01	01	01	I think the program is great, the teachers are very helpful, I learned a great deal and enjoyed being there.
01	02	01	I hope that the curriculum is being updated with instruction on computers. I'm finding that computers are being used in so many applications. Examples are: Detroit Diesel's Fuel injection system (new); Bosch's Fuel Injection system (new); John Deere's Hydraulic system & performance monitor (new); Twin Disc's Powershift transmission (new).
01	01	01	If I were to take the course again I would like to see more time spent on diagnosis of air conditioning systems, diesel engines, hydraulics, hydrostatic transmissions, electrical, etc. because knowledge in being able to tear down and know what is inside a component is important. I feel that we as mechanics have to change the attitudes of our customers of us being just parts changers. And I believe this instruction should include use of state of the art equipment to diagnose with and work on and also the very old equipment to work on and diagnose with.
01	01	03	I like the hands-on work we did, the more the better. More advanced math classes would help. Basic shop (general) practices is a very excellent class. The course is excellent, compared to other colleges!
01	01	03	The only course that could have been improved on when I attended Ferris was hydraulics, hydrostatics. Those areas were very important in every job I've had.
01	10	22	I would be very interested seeing the new facilities in action. It has to be better than the building across the river?

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COMMENTS BY GRADUATES WITHOUT ADDITIONAL DEGREES

In Bu Jo   Comments
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01 10 22
I wish Ferris could offer courses to update myself on the changes in technology. I am very interested.

01 02 27
During my 2 yrs at Ferris 'basics' were strongly tought. At Case, I have specialized in many product lines in both AG & CE and have been able to adapt quickly to new product because of this. A course in transmission control and hydraulic systems would teach how basic electric & hydraulic & powertrain principles all work together. System troubleshooting procedures would be a highlight to this course. A reason for this is there are no longer simple electrical systems or hydraulic systems. Transmission controls are getting more and more complicated. However they are made up of many 'basic' systems. Knowledge on individual electronic components (black boxes) is not needed. Even at the corporate level most of our engineers don't understand them but know what they want them to do. Also tell students opportunities are out there.

02 01 01
I am no longer in the heavy equipment field, I am currently working at an automobile dealership.

02 01 01
Many of the instructors at the time I was attending needed training more than I did!

02 31 01
Keep getting new instructors in that know their stuff about the HE field like the group of instructors you have now.

02 01 01
The reason my answers may seem odd is when I was first out of college I worked for a large construction company mainly on heavy equipment and semis. Since then I have

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COMMENTS BY GRADUATES WITHOUT ADDITIONAL DEGREES

In Bu Jo Comments

changed to a GMC dealership and am working on medium and light duty trucks, mostly on the new 88 Sierras.

02 08 01

I feel the courses are set up very well as they are. You get a very good background of all basic areas but will always need training on the job or at factory schools because technology is changing so fast it is hard to keep up and a very good understanding of basic principle operations of units is important and should not be compromised. Try to keep up with the growing technology.

02 01 02

Be advised that air conditioning service procedures will be changing in the near future due to EPA regulations concerning discharge of freon into the atmosphere.

02 34 02

I honestly feel the basic training in power plants, basic clutches, basic drive line and basic electrical are most important. And also (at least at the time of my education) were for the most part overshadowed. I believe that employers willing to hire college mechanics, don't necessarily require personel to know injection overhaul, or driveline rebuild. As we have to face the fact that our trade is one that is creeping toward extinction as we know it. I feel the person that pays for an education should be spared the B/S and taught the very important basics.

02 01 03

Had this survey been taken sooner, the answers would have been completely different. I've done over 1,000 auto trans rebuilds in a job I've held for 3 years prior to my present position with K Mart.

02 01 03

I remember very vividly the amount of time you spent teaching us the importance of effectively troubleshooting a hydraulic system. Unfortunately I believe the rest of

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In Bu Jo Comments
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the program lacked in that area. When I graduated and started working as a tech., I was frustrated with not being able to diagnose a system, for instance, an electrical problem. Whether that was my problem or not, I don't know. Fortunately, my service manager was also a HES grad and helped me. I feel the curriculum needs a diagnostic course or troubleshooting course. I've heard some instructors mention that too.

02 02 04
For the past 7 yrs, I have not been involved with the heavy equipment field. I made the transition to the automotive field after 2 yrs with heavy equipment, first with Cummins Diesel then with Detroit Diesel. I then went to work at a Volkswagen, Porsch, Audi dealership and worked for 5 yrs as a technician. Then I went to work for Audi of America as a Product Quality & Warranty Specialist and recently became the District Service Manager for North Texas and Oklahoma. The education I received at Ferris provided a very good working base of the way equipment operates and has made all of my past and present jobs a lot easier. Since going to work for Audi I have met quite a few Ferris Graduates within the VW/Audi corporation.

02 01 05
How about a '79 class reunion!

02 02 10
I feel that strong consideration should be given to electronics. As technology presses on, manufacturers of fuel systems, engines & drivelines utilize electronic devices and sensors more and more. Without a thorough understanding of electronics, I feel the future technical knowledge will be lost.

02 02 10
I hope the Ferris State HE program continues to give the high caliber of education it has thus far. My training there was the best investment I ever made. Thanks for caring.

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In Bu Jo Comments
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03 30 01
I think that there should be more hands-on troubleshooting in electrical & hydraulics. Also less time spent on fuel injection pump & injection repair because every place I have worked, that work is all sent out to specialty shops.

03 01 01
Powershift trans should be talked about in great detail. More diesel engine troubleshooting - most students coming out of college can't even tell if an engine is missing! Need to update your instructors.

03 01 01
Troubleshooting is very helpful tool in any part of the mechanical field. I know that time is limited for teaching in the classroom, but I think that this area should be covered more in depth.

03 01 01
Heavy Equipment spends to much time on fuel injection and not enough on hydraulics. They could also use a class on powershift transmissions.

03 01 01
The more experience I gain I really realize how well the Heavy Equipment Program gave me a very good base on which to build. A really good program, keep it up.

03 01 01
Is there a trade teacher tech program in Grand Rapids that I could get my teachers certificate, without going to Big Rapids.

03 01 01
The HE program at Ferris is no doubt the best in the state. I was very well prepared when I entered the field after graduation.

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COMMENTS BY GRADUATES WITHOUT ADDITIONAL DEGREES

In	Bu	Jo	Comments
03	10	01	Ferris has helped me very much in this field. I am very grateful that I chose Ferris!
03	30	01	In my present job we are heavy into Allison Automatic repair. Before this job, even in school there was not enough class on the basics of these transmissions. I also would have liked more information in hydrostatic drives put into the classes. I feel that other than these your classes showed me the basics very well.
03	02	01	I am attending the University of Michigan full time.
03	01	01	I feel I was very well prepared for my job due to the training I received at Ferris. The basics that I was taught apply to almost every troubleshooting job that I am involved in.
03	10	02	I would stress to anyone in the curriculum to take the time to complete the 4 yr program.
03	01	13	The knowledge learned from the college has been very useful in my career.
03	01	18	In my present job I work with customers in predicting failures and how to help preventing them. The most important tool I see is oil analysis.
04	01	01	HES needs more hands-on in these courses; Hydraulics & Electrical! Then, put the book in their hands to study.

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In Bu Jo Comments

04 10 01
The courses are quite good, the one that is the best is the hydraulics course. The Instructor made you think in order to get real good grades. Thinking is what students need to learn most. There are too many parts changes working in this field now. You should have welding in the Task Inventory. I do a lot of welding & fabrication. Also paint & body work could be inserted in the inventory.

04 01 02
I feel more time should be spent on preventive maintenance, tire repair, brakes, & suspensions. Most mechanics start out doing this type of work rather than engine work.

05 01 01
I would have liked to work toward my teaching degree at FSU. However, prevailing circumstances would have made it difficult to move to the Big Rapids area.

05 08 01
Ferris left me very unprepared for life in the heavy equipment field. If there was an apprenticeship program it wouldn't have been as bad. Experience is one thing that employers look for, and one thing graduates don't have.

05 02 01
Air suspension systems should be explained (how they really work) not just pictures of them. More time should be spent on preventative maintenance not the paper work but doing the service. Every one should have the opportunity to do a complete service, including brake adj, clutch adj, wheel bearing adj, cab tilt, chassis lube, U joint removal and replacement. Teachers should be attending factory service schools to keep up. Your faculty is not keeping up with today!

05 07 01
A course in Industrial Psychology would be helpful. I personally have found that my training puts the people

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COMMENTS BY GRADUATES WITHOUT ADDITIONAL DEGREES

In Bu Jo Comments

around me on edge, be it due to my skill and knowledge, or the impression that I am supposed to "know it all." It is also hard for me to see that not all my co-workers are as knowledgeable in the repair field as I feel they should be. I find that I do the vast majority of troubleshooting and major jobs in a shop of 7 mechanics, and yet not being compensated for the difference in work done. If I had to do it over, I would not change majors or schools. A great deal was learned in BR both in and out of the classroom. Hope to see the new place one day.

05 30 01
I always hear good comments about Ferris Grads out here in the field. I feel that I am more accepted because of my Ferris education.

05 11 01
The transit industry contains a lot of equipment that has a lot of electronics, ie. air conditioning, interior and exterior lighting, fuel injection, automatic transmissions. I feel it is a must that anybody entering the transit industry have good understanding of electronics, along with air conditioning, air brakes and some understanding of hydraulics.

05 08 01
Air conditioning should be considered because 98% of the trucks I encounter are equipped. Also if you haven't done it already, drop the stupid health ed. requirement and make first aid a requirement

05 04 01
Very good program. Covered all aspects of the heavy equipment field thoroughly.

05 10 01
How to do the work without school's fancy equipment!!

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In Bu Jo Comments

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05 07 01

Tearing down of trans & final drives was a waste of time. This is a specialty. Either thats all you do or you don't. Rebuilt components are the norm. Also more should be gone over on the CAT system on fuel injection. The new electrical systems in trucks,--Red Dot, Kysor, the new EPA regulations in the 90's. These things I deal with almost every day. I don't want to sound too critical, it was a good program. I enjoyed the experience. I recommend Ferris all the time!

05 01 01

My job today is due to Ferris State's reputation in the industry. Keep up the standards. Thank you for the education!

05 01 01

I sincerely don't think any changes are needed other than keeping up with new products and updates, that in itself is a big task. I only wish I had a memory like a computer because my stay at Ferris would have made one of the best mechanics around. Keep up the good work.

05 01 01

Due to emissions, the over-the-road truck engines are becoming computerized. A course in computer & electronic troubleshooting is a must.

05 01 01

On the job training at Ferris was NOT as good as it could have been. It was lacking in Heavy duty drives. I lost several jobs due to lack of training in this area. Hydraulics NOT stressed enough; NO training on tractor trailer maintenance. I was very disappointed with schooling received after I got into the field. No ref training-no farm tractor drive training. Fuel inj class was good, but not enough on troubleshooting. Refrigeration training should be put in the curriculum. With the training I received in HE I was not able and still am not able to get a job. Job placement was very

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In	Bu	Jo	Comments
			poor. I feel the school should be divided into 3 categories: Farm Equipment; tractor trailer truck repair; heavy equipment.
05	01	01	Tear down & rebuild Cummins & Cat engines. Explain all aspects of parts, eg.-fuel, injection, timing. This would benefit the students more so than anything else. Good points I liked and learned from - hydraulics, electrical, brakes, LESS fuel injection. Needs more engine work - specific engines!
05	34	01	New style diesel computer injection controls & need more emphasis placed on heavy duty truck steering & suspension operation & rebuilding. Also heavy duty truck electrical systems. Note: when I attended Ferris State back in 76-77 these areas covered in my classes were applied too much to the automotive field.
05	08	01	In #21 the reason I put computer classes was because the shop I work in now is going to computerized shops, to cut down on paper work and also tells the foreman which worker is best for the jobs that are available. The shop I work in is Ryder Truck Rental; the largest rental co in the world! I have been working here for a little over a year.
05	01	01	Include basic elec. in other HES elec. courses. Brakes should be covered in 5 wks. with remainder on tandem axle alignment (major concern today). Trucking students take final drives. HE students take hydraulics. Gentlemen - never slack on the general academics of the HES program for any reason. Maintain the minimum (or up it) math level. We need to use the numbers, and especially, w/electronic controls the present rage. Three terms English - great, nothing like being able to write and spell it right. My psyc. class was a waste, but not every program is perfect. But HES needs to be current, if

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In Bu Jo Comments

nothing else at all. It has to train for today & tomorrow. Be current and allow for selective flexibility.

05 10 01
In my situation air conditioning is in place on 75% of all company vehicles. I took A/C at Ferris as an extra class and I proved to be more rounded in A/C operation than others I worked with. Also after being hired I saw A/C training as a factor in mechanic selection. A mechanic with training 2 out of 3 times was selected over equally qualified mechanic without training. Keep up the good work!

05 01 01
The program I went through was good. It taught me the basics of how to do most of what I do at work. The rest is on the job training that you can't get in any school.

05 06 01
It's been awhile since HES, but the fundamentals I learned have served me very well. I think the course was very complete. The only thing I can think of is keeping up with the many changes, which I imagine you are already doing.

05 34 01
Most of the basic classes are covered before, and are a waste of time when students could be learning something new. Basics should be covered briefly at the beginning of the courses.

05 01 02
The program helped me to advance more rapidly in my jobs. You should try to update on products, many have changed over recent years,.ie; the Cummins, Cat & Detroit engines I trained on were out-dated when I entered the field. You should offer a class on D.O.T. specs & regulations,as they are becoming more critical all the time.

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In Bu Jo Comments
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05 04 02

Too much automotive training in the HES--deemed nearly useless in the field, ie. fuel & elec class. Not enough emphasis on simple equipment maintenance-perhaps the biggest problem out there, ie. oil changes, grease locations, fluid levels, etc. Too much overview; too much wasted time in Shop Service (Service Floor)--could be better utilized in basic troubleshooting; they more or less throw you on a job, you muddle thru, learn a little and move on. That's what job experience is for. I would expect more structured training. How to be a mechanic: be organized, clean parts, exercise parts analysis, listen to an engine, look for failed parts, ie. broken springs, brackets, worn bushings, shafts, etc. How to find leaks, simple stuff!!! I'm grateful for what I learned in HES -- mostly it got me in the door.

05 07 03

I feel I received a well-rounded education at Ferris. when I left & started my first job, I feel I was capable of picking up where my education left off & adapt to the real world of heavy equip. service. Although it's impossible to teach every student everything there is to know in this field, I feel that in-depth training courses should be offered (not necessarily required) to students in this curricvulum, involving direct hands-on experience on specific engines & component systems. This I believe would better prepare your students who have certain goals in mind, or inspire goals into the mind of those who are uncertain which way to turn in this vast field of study, which encompasses so many industries and so many machines.

05 04 05

Hydraulics (cyl, pumps, valves) Power Steering (an excellent growing business); more transmission, differentials (class time) fuel injection (big business) You have an excellent program. Keep it up!

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COMMENTS BY GRADUATES WITHOUT ADDITIONAL DEGREES

In Bu Jo Comments

05 01 07
Air conditioning service, variable step timing on diesel, electronic fuel inj, electronic speed governors, & control on the new diesels. More overall electrical, ie, cruise control, heater & air circuits, Kysor system sensors & controls. While at Ferris I thought that the courses were adequate. The service floor though needs to be geared more to trucks than to farm tractors since most job offers are in the trucking industry. Rebuilding of components (ie. transmissions, rear ends, alternators, & starters) is almost a thing of the past due to manufacturer rebuilds. The cost for down time factor makes rebuilding a last option in todays shop market. All that is needed is the ability to troubleshoot components, and the theory of operation.

05 31 07
Maybe some introduction to LP gas fuel systems as I had to educate myself in this area as the trucks I am responsible for are all run on LP gas. For interested students, maybe an offered class on setting up your own business (costs, overhead, bookkeeping, taxes, etc)

05 10 28
Injector pump & injectors rebuilding course is not necessary unless you work in a specialty shop. Parts department is one area very lightly touched on although it is approx 1/3 of the heavy equipment field. A lot of good paying jobs are available in this area and it should be considered for a class.

05 10 28
The service floor operation should be on heavy equipment, not pickups, cars, lawn mowers, old tractors, and building asparagus pickers (that was really a joke!).

07 01 03
When I took HES our class was in the old building on the other side of town. I have heard of the new building and have been in town to see it. Unfortunately it was on a

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weekend and of course, it was locked up. HES was a very good course when I took it and in the FSU tradition, I am sure that it is even better now. Yes, I am looking forward to coming up to FSU this winter to see it again, during the week (because my business is seasonal) to bring up good memories.

07 31 07

I think that there is a need for knowing how to use more advanced methods of troubleshooting & assessing the condition of diesel engines such as fuel system pressures, pyrometer readings & crankcase pressures & more. Of course, there is the need for staying abreast of new ideas and R & D - kind of a "new research trends" type class covering ceramics, turbo compounding & electronic fuel injection. I found that my HET program at Ferris was one of the best compilations of knowledge & experience I have gotten in my life. Keep up the good work!

09 02 27

Altho I only worked in the HE field for a short time, my training at Ferris has not been a waste. The training I received in engine rebuilding, troubleshooting, air brakes, and hydraulics has helped me tremendously since I started working in the chemical industry in 1981. These skills allowed me to learn much more quickly and with more complete understanding than most other employees at the two companies I've been with. This has helped me to advance very quickly. There are a lot of industrial equipment and chemical process control systems that the same principles of pneumatics, hydraulics, and mechanical know-how apply to.

09 23 29

As a suggestion, I feel the assistance in job placement was lacking in thoroughness and follow-up on the part of the College. My overall impression of the program was and is that it gave me the skills to do the work, but lacked

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in the skills to land the job. Also, I felt once my time at Ferris was up, my 2 yrs, I got the old "thanks for the money for tuition." It was like, don't call us, we'll call you.

10 10 01
Send no more mail to me.

15 01 01
I would like to further my teaching education degree. Could Ferris offer some education classes that would be in my area.

15 01 02
I work as day floor supervisor for Cummins Mid-States Power. Dealing with the mechanical part of the Cummins engine is no problem, dealing with the new electrical products, and being good at it is. With Compuchek, Compucruise Pace and the 1989 ECI engines, it is very hard to stay on top of it. Five years from now, a diesel mechanic will need a lot more than a tool box and wrenches.

17 43 01
I feel that my comments on this survey are slanted because I'm in the US Marine Corps. My job entitles me to work on a light armored vehicle. It's basically a tank on eight wheels and is lighter with a smaller weapon. I perform maintenance which consists of troubleshooting and remove and replace only. I do not get to rebuild any components. I await for the end of my contract so I can return for the AHT program. I have been unable to find anything comparable to the programs at Ferris.

17 43 45
After graduation, I felt the Heavy Equipment field seemed burned out, or too full. A job was hard to find. No one wants to hire anyone without experience, and although the 'service floor' gives some of that, there were too many unemployed people with experience. So... I joined the

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In Bu Jo Comments
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USAF and now I work on electronics (ie radar, indicators, transmitters, receivers, video processors, etc.). My heart is with my tool box, however, and I really enjoy the time I get to help a friend out with his car, or even fixing my own. The knowledge I learned from FSC is not lost. I intend to use it one day. But right not I feel the time is right to open other doors with additional career knowledge in other fields.

17 43 50
I am unable to make any suggestions for I have not worked in this field for 4 yrs. I am currently doing microwave and tropopheric scatter communication systems repair and plan to obtain a degree in electronic engineering tech.

19 03 01
The instructor is a very important part of the program. When seeking new faculty, try to get the best men you can find. I went through the program when it was at 1010 E Madison, the facilities were minimal, next to nothing, but we had some exceptional instructors, that really made the program a winner.

19 30 01
Manuals are hard to follow when you can't understand the blueprints or the codes used by the mfg - also students should know that not all blueprints are 100% accurate. Students should have at least one job, while learning skills on the Service Floor that they have to finish within allowed flat rate time. I would like to take additional classes sometime - at present, I don't have the time to spend in study or the money.

19 30 03
Students in the 6th quarter should go out on co-op, get into the field, working on Service was good but most of the employers I talked to didn't care. They wanted work experience, & references from previous employers. Many of the potential employers said you are over qualified, and under experienced. I really enjoyed my time at Ferris.

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And have recommended many people to attend Ferris as well as the heavy equipment field.

19 17 51

Presently in the coal mining industry we are using more battery and diesel powered coal haulage equipment rather than the older style AC powered machines.

30 01 03

In the material handling industry (fork lift trucks) the major reasons for service calls are as follows:

1) No Start
   - A) Cranks, but won't start
   - B) Does not crank
2) Unit runs but will not move
3) Unit leaks

32 32 05

I think a graduate with a strong background in hydrostatics, hydraulics, electrical & diesel engines would be of great interest to the ski industry. There is a growing need for top notch mechanics with opportunity for advancement. As a whole, there is a need nationwide for mechanics, welders, lift mechanics with good electrical and mechanical skills, snowmaking and pump technicians. The list goes on and on. The ski industry needs qualified people who like the outdoors, enjoy people and enjoy skiing. The pay is decent, the benefits financially are not great, but most areas offer free skiing to employees and families. I am not in need of any mechanics right now but there are plenty of areas out here in the East that are.

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COMMENTS BY GRADUATES WITH ADDITIONAL DEGREES

In Bu Jo A TY Comments
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01 01 06 y 03
I am doing very little mechanical work at the present time. I am now a general manager and in sales.

01 09 06 y 07
I feel that more time should be spent on electrical troubleshooting ie: VAT 40 and scope use. More time on diagnosis and less on rebuilding of fuel pumps and injectors. You just send them out in the real world.

02 01 01 y 01
I see no problem in the present course concentration as long as the courses keep up with new technology. I cannot answer the previous page accurately at this time, because I work in an automotive shop where most of those things aren't encountered. I enjoyed my enrollment in HES. The instructors and facilities are the best I've dealt with.

02 34 02 y 01
FSC prepared me to perform well in all areas of automotive and HE repair and preventive maintenance. Please continue teaching theory! By and large employees under my supervision lack the knowledge of theory of electricity, hydraulics & friction (ie-loads on shafts, clutches, etc) needed in troubleshooting. We often end up with a repaired effect and repair the cause on a comeback.

02 02 05 y 01
Provide more school owned equipment. I hope that Ferris is not so dependent on local gravel companies as they were in 1978. Remove the politics from the curriculum!

02 31 07 y 01
Although I have an A.A.S. in Auto Service, I still feel that more attention in the computer controlled fuel systems and electronic systems in general would be very beneficial.

02 03 01 y 02
If you add to your curriculum and offer to past students,

APPENDIX XXXXIV

COMMENTS BY GRADUATES WITH ADDITIONAL DEGREES

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In Bu Jo A TY                    Comments
== == == = == ==========================================
   it would be nice to have some night courses available for
   the people who work and some update classes would be
   helpful.

02 01 03 y 03
   My current job as a Service Director of an automobile
   dealership does not allow me to spend much "hands on"
   time repairing.  I do directly supervise the repairs of
   25 technicians.  Skills and concepts learned at Ferris
   have enabled me to make productive decisions and build a
   profitable service facility.  Other than keeping up with
   the technical advances of our industry, I would not make
   radical curriculum changes.  Teaching students the basics
   and relating them to current technology is the most
   important thing Ferris can do for a student.

02 01 03 y 03
   Because I went through the AHT program and now work in a
   "hands-off" position, my survey may be of little help to
   you.  Even though I don't turn wrenches I do find my
   technical background very helpful as an Asst. Mgr.

02 02 04 y 03
   In this business (auto or heavy equip) a class on stress
   management should be part of the program.

02 02 04 y 03
   I haven't seen the new Heavy Equipment building yet, but
   in my opinion, the old warehouse facility was more like
   what can be expected when the students enter the job market.

02 02 04 y 03
   Stress to the student to get fully certified.  Get a lot of
   retail experience.  When making a wholesale decision you
   must have common sense which comes from retail.

02 02 04 y 03
   Answers to question 20 are in the point of view of the mfg.
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APPENDIX XXXXIV

COMMENTS BY GRADUATES WITH ADDITIONAL DEGREES

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In Bu Jo A TY                 Comments
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   I discuss these topics on a daily basis with the 58
   service mgr/dlr operators that I am currently responsible
   for.

02 02 04 y 03
   I feel with the addition of the new facility the HE
   program should be able to turn out quality technicians.
   I only wish I could have attended classes in the new
   building.

02 02 04 y 03
   I am looking forward to seeing the new H.E. building, it
   was long overdue.

02 02 04 y 03
   I hardly use any of the things studied in HE since I now
   just work on cars & trucks.  I handle reimbursements for
   Chevrolet customers, and the items marked on section 4
   (task inventory) are the situation I handle most.

02 02 04 y 03
   For the automotive course, several basic electronic
   courses & computer courses would be very beneficial.

02 02 04 y 03
   My current position does not require specific or in-depth
   knowledge of any one system or component.  My overall
   knowledge provided by the HES program, of automotive
   systems has been very important.  There is much demand
   for graduates of this, or similar programs.  Keep up the
   good work and always continue to strive for improvement.

02 02 04 y 03
   1.  Increase electronic fuel injection
   2.  Tool identification should be decreased

02 02 04 y 03
   I'm a Service Rep for an automotive company (BMW of North
   America). Therefore, unfortunately, many of the subjects
   I learned in HES have been unused because they are not
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COMMENTS BY GRADUATES WITH ADDITIONAL DEGREES

In Bu Jo A TY Comments
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applicable. I must admit I do certainly miss dealing with heavy equipment. BMW has a prestige image, but sometimes their owners (our customers) are a real pain in the rear. Instead of dealing with having to miminize downtime on an earthmover that is going to hold up a major construction project, we are dealing with Mr. Smith who wants his complete climate control system replaced because he says when he sets it to 72 degrees his thermometer shows its actually 74 degrees; and, he wants a free rental while the work is being completed! I'll get back into the HES field sooner or later, if it's the last thing I ever do!

02 02 04 y 03
Need to work on getting "new" product information to the students.

02 02 04 y 03
I am currently a District Service Manager in the states of Kentucky, Tennessee, and Alabama. Although I rarely work on vehicles, I draw my knowledge from many classes that I have had at Ferris. My knowledge has been proven sufficient when talking to technicians, customers, and during arbitrations at the Better Business Bureau. I feel that my technical knowledge has helped me far more than my management skills in my present job. Although a big part of my job is Customer Satisfaction, I find that utilizing my technical knowledge to explain conditions to customers helps to prevent future questions in addition to the issue at hand.

02 36 05 y 03
Make students aware of other opportunities beside turning a wrench 8 hours a day. Professions such as technical writing, training writers, time study technicians and instructors allows a person to keep up with the latest technology, hands-on validation, and diversify themselves into other areas.

02 02 05 y 03
Task inventory does not apply to my current position. I

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COMMENTS BY GRADUATES WITH ADDITIONAL DEGREES

In Bu Jo A TY Comments

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deal with lemon laws, arbitration and class action suits. Previously I had been dealing with all areas of auto diagnosis.

02 02 05 y 03
I am unable to comment on any changes in the HE curriculum. I went on to AHT and am employed by Cheverolet Motor Divison as a service and marketing rep. I did not put to use any of the skills I learned in HES.

02 02 05 y 03
Being that I have never obtained a position in the HE industry, it is difficult for me to foresee any changes that are occurring.

02 01 05 y 03
This program gave me a good all around overview on what I might encounter in the real world. Manuals should be made part of the required list of tools for being on service floor & how to use them to save time & problems.

02 01 06 y 03
Go deep into A/C-electrical-ABS-SRS-CIS/CISE-computers. These classes were either not available or were very brief.

02 37 07 y 03
For me, success is not so much what you know, although it is important, but that you are willing to work, to give 100%, do the unexpected for your employer. "Who" you know is as important as "what" you know and having guts is what it takes in the advertising business. Lots of politics. Learning to keep quiet, learning to network others for leads. Owning a business is gutsy; especially when you have a wife, three children and a mortgage.

02 31 07 y 03
It would be helpful to have a booklet for sale on new (early 80's) updated equipment.

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COMMENTS BY GRADUATES WITH ADDITIONAL DEGREES

In Bu Jo A TY Comments

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02 02 08 y 03

I've found basic shop practices and basic hydraulic classes very useful. Time management, quick troubleshooting and repair needs to be stressed in order for a flat rate technician to make a good living. Clean & neat shop area and the appearance of the technician are important to improve the image of technicians. AHT program is highly recommended!

02 15 14 y 03

I'm sure you are aware of this, or at least have heard it before - Ferris State really does have a super reputation in the automotive (Heavy Equip) field. I've worked in the Const. Equip. Industry for 2 yrs and most everybody that sells or services big iron thinks very highly of Ferris' Program. EG: when I left AIS Const. Equip. Co. for this State job, we had 3 Ferris grads all under 30 years old in management. That company is the largest construction equipment co. in Mich. They love Ferris people.

02 01 18 y 03

In my position of sales, a mechanical background is very useful selling trucks and cars. Customers have much more faith in a salesperson who knows what he is talking about. It is also very beneficial when it comes to appraising a trade-in.

02 01 18 y 03

I enjoyed going to school at Ferris. I feel it is a very good school for my curriculum especially.

02 01 26 y 03

Need to offer an MBA degree.

02 02 26 y 03

Continue to include courses that relate to the latest advancements in all areas of the HE industry as it relates to components, complete vehicles, testing equipment,

APPENDIX XXXXIV

COMMENTS BY GRADUATES WITH ADDITIONAL DEGREES

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In Bu Jo A TY                Comments
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   troubleshooting, repair techniques, etc.  Be especially
   receptive to all areas that utilize computers and
   electronic systems controls.

02 01 26 y 03
   My present job pertains to automobiles and not
   specifically diesel motors.

02 02 10 y 03
   The HES degree is worth more than the AHM degree!  Unless
   you don't want to turn a wrench.  All things being equal
   I have a better career with the HES degree, but I do not
   want to turn wrenches for a living.

02 02 09 y 04
   More emphasis on chassis & engine electronics & electrical
   diagnostic work & more training with diagnostic equipment
   in general.

02 02 04 y 05
   Electronics are becoming more common in automotive & H.E.
   applications.  The ability to understand & diagnose these
   systems will give your students an edge.  Computers are
   also being used in the shop now for diagnosis of
   micro-computer systems & also for Repair Orders and technical
   data storage & retrieval.

02 02 04 y 05
   I am currently employed by Ford Motor Co as a Field rep.
   therefore I never actually get involved with hands-on
   training (mechanics).  However, my background has helped
   me greatly in counseling my dealer customers.

02 04 07 y 05
   My education and experiences at Ferris where great.  I may
   not use all of the skills taught, but a day doesn't go by
   that I don't tap into what I learned while attending Ferris.
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COMMENTS BY GRADUATES WITH ADDITIONAL DEGREES

In Bu Jo A TY Comments

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02 02 27 y 06

The Heavy Equipment program gave me a good "hands on" mechanical background, which definitely helps me with my work as an engineer.

02 02 29 y 07

The heavy equipment curriculum was a very good experience for me. As I went into research & development out of school, I cannot say if there should be any classes added at this time. I know when I attended school I thought the classes that did not pertain to heavy equipment were useless, but I have since changed my mind! Keep up with the times - we were behind the times with the equipment we had in the shop when I was enrolled. Make education fun to learn, the students will benefit more from it.

02 02 53 y 07

I worked at Atlas Truck Rental & Leasing in Grand Rapids for one year. I did general repair, a lot of electrical, lights, starters, suspension system rebuilds, Diesel tuneups. I now work at Progressive Die & Automation. I went to GR Junior College in the Tool & Die Program. I will get my Die Makers card in January 1989.

03 01 01 y 01

The program I went through in 79-81 was very well rounded.

03 23 06 y 01

I'm glad to see the program headed upwards. I feel the program has taught me a great deal. Right now I work for a construction company with my father-in-law. We've grown from 2 trucks to 4 trucks, 2 dozers, 2 backhoes, loader, etc. I feel the program has helped me very much in understanding the operation of equipment. Maybe the program should offer such a class. Operating equipment plays a big part in mechanics.

03 01 28 y 01

The HES curriculum at Ferris is still very widely respected

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COMMENTS BY GRADUATES WITH ADDITIONAL DEGREES

In Bu Jo A TY Comments

in the job market. It's something you all can be proud of. Thanks for a career. Looking forward to touring your new facility.

03 01 01 y 02
Working in auto machine

03 01 01 y 02
After going to Ferris for 2 yrs, I learned more on my first job than in any of the specific subject courses taught in heavy equipment. The HES course should be for 3 years and add hydrostatic drives as a course by itself. Also add automatic transmissions used in heavy equipment. I am only satisfied in the degree and not the course. I am glad I took auto machine as a back up course.

03 01 02 y 02
The current trend is towards more electronic controls and monitors. A good understanding of basic electrics and troubleshooting is critical. Training in specific areas is good but a thorough understanding of basic concepts and theory is much more important. With a good background in the basics, a more detailed knowledge of specific systems can be understood much more quickly. Also, stress good work habits and good ethics. Keep up the good work in hydraulics and hydraulic troubleshooting. More if possible!

03 01 03 y 03
There needs to be more emphasis on tracks & undercarriage systems for the students who care to move into the construction field. I feel that we work on 70% track & undercarriage related problems on a daily basis. There should be more information now than there was when I attended on hydrostatic transmissions - HLR transmissions. I feel these would help the students out immensely.

03 23 07 y 03
As owner of a building restoration company in the Cleveland area, I own & operate many different pieces of equipment

APPENDIX XXXXIV

COMMENTS BY GRADUATES WITH ADDITIONAL DEGREES

In	Bu	Jo	A	TY	Comments
					(compressors, trucks, small gas engines, etc.) which need fixing all the time. My HES background is invaluable.
03	02	21	y	03	I would be interested to find out how many graduates, after ten (10) years, are still in the automotive industry.
03	01	28	y	03	Generally had a very good all around education and am very happy with what I was taught.
03	02	01	y	05	My company manufactures asphalt plants & components. I primarily troubleshoot the control systems of these plants. Secondly I train, not only our own people but we put on six customer schools a year. For our own people we have service, sales & specialty schools for domestic & international personnel. Our industry needs people with 1: Electronic skills-- computer, 3-phase, high DC, 120 Vac and be able to follow prints. 2: Industrial burner skills. 3: math--a good background. 4: Iron - erecting steel (50 ton units) we do use gear boxes. 5: Material handling - conveyers etc. Also blueprint reading & especially safety minded.
03	02	04	y	05	If you keep teaching the basics, the students will be able to grow in their special areas.
03	23	13	y	07	A good program. What else can I say!
05	08	01	y	01	Must stress electronic education - everything is going computer controlled & digital.
05	01	01	y	01	Ferris is a very good school & I enjoyed it & benefited well from it. Thanks.

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COMMENTS BY GRADUATES WITH ADDITIONAL DEGREES

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In Bu Jo A TY                    Comments
== == == = == ==============================================
05 07 01 y 01
   keep up to date, and don't forget the small items.

05 02 01 y 01
   An electrical troubleshooting course including setting up
   a complete vehicle lighting system. A hydraulic system set
   up including hose making and types of fittings, reducers
   and Hyd pump set up off a PTO system (trucks). If possible,
   split students into farming, trucking, construction.

05 01 01 y 01
   Less classroom and more hands on training.  Update courses.

05 01 01 y 01
   Keep up the good work.

05 30 01 y 02
   Hydraulics should be the subject to key on, advancements from
   year to year is unbelievable.  Screen the students to see if
   any mechanical abilities are in them & separate them from the
   ones that have gone through auto machine or auto service
   or individuals with some kind of background.  If memory
   serves correctly most classes would have been more
   interesting if the small majority who shouldn't have been
   there were not.  Mechanical abilities is like sports,
   everyone cannot be a pro & with the cost of education, only
   to be fair to the more advanced individuals possibly another
   2 quarters need to be added to the slower student and I
   believe better well rounded students will graduate out of
   Ferris.  I don't mean to be negative, I received a good
   education from Ferris even tho there was boredom.

05 08 01 y 03
   I wish I would have recognized the importance of good marks
   when I was at FSC.  I would have paid more attention and
   not goofed off so much.  When passing grades are made too
   easy to achieve, it is a loosing principle.  A low standard
   of grades will not implant dependable and responsible
   mechanics in the field.  I don't want this to sound like a
   bad attitude, but it is what I see as a problem at FSC.
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APPENDIX XXXXIV

COMMENTS BY GRADUATES WITH ADDITIONAL DEGREES

In Bu Jo A TY Comments

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I remember my Humanities instructor telling me that his manager (the dean?) told him to make the test easier. Stress working with parts manuals even on tests, eg. I never learned how to adjust a spicer clutch internally when at FSC. The first time I had to do that, it was embarassing. If the instructor can't read the answer to test questions because of poor penmanship, the answer should be wrong. Writing Repair Orders is important.

05 34 02 y 03

Keep courses updated - electronic controls on Cat, Cummins, etc. New seals - can't use wear sleeves, must replace yoke, etc.

05 08 02 y 03

I work in an emergency road service department for a truck leasing company. Every day I am required to make quick decisions to provide the most timely and cost effective repairs. Troubleshooting skills are a must. Areas that commonly come up are: fuel injection systems; air brakes; heavy duty drives; charging & cranking systems. All repairs are handled over the phone by using our branches and outside vendors. 24 hrs, 365 days per year.

05 01 02 y 03

My job is too demanding to be interested in taking additional courses or refresher courses. They are currently giving us home study books which include tests. If you do well on them, prizes are awarded. Todays employers expect 110 % of your time, both on and off the job. They want you to do more than ever before and in less time!

05 04 03 y 03

Continue to teach basic fundamentals in each course. Never assume a prospective student knows anything about HES. There are many misconceptions presented by employers and fellow mechanics that confuse those who are not knowledgeable of basic fundamentals.

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COMMENTS BY GRADUATES WITH ADDITIONAL DEGREES

In	Bu	Jo	A	TY	Comments
05	01	18	y	03	I am still in the AHM program. Math 140 is a required course. On my internship I found that I was severly lacking in knowledge of MS-DOS procedures and with using hardware - hard drives.
05	01	18	y	03	After graduating from HES, working 2 yrs in the field, and returning to complete AHM. I am now back in the field. I STRONGLY urge you to DISCOURAGE HES graduates from going into AHM. Very few, if any, HE or trucking people will recognize or respect the AHM degree. Two years of shop experience will be more beneficial than AHM. I speak from experience!
05	15	23	y	03	Automatic transmissions should be added as a required course. Diesel engine rebuilding, at least 1 engine as a requirement, maybe 2 different engines - should be rebuilt on the service floor at the time. A Preventive Maintenance class, one that teaches proper ways and theories behind a Preventative Maintenance inspection. I would not mind coming back and seeing the changes made at the school since I left.
05	01	30	y	03	For the 4 yr AHM degree - lose the Algebra II requirement and put something useful in its place - like business mathematics.
05	10	03	y	03	1. Disc brakes should be part of HES 204 suspensions & brakes as well as, "the importance of tires in relation to suspensions & final drives." 2. More emphasis should be placed on electrical trouble-shooting. 3. HES 206 hydraulics, needs more hands on problem situations, "troubleshooting."
05	01	01	y	04	Make service floor MORE PRACTICAL! Design better lab tasks

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COMMENTS BY GRADUATES WITH ADDITIONAL DEGREES

In Bu Jo A TY Comments
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to involve students during DEAD TIME. Teachers on service floor, and those teaching classes, need to take updated courses in their fields. They are PRESENTLY WAY OUT OF DATE in the knowledge that they are teaching the students!

05 02 04 y 04
I would be more than happy to come talk, give a school or provide information on Fuller transmissions.

05 03 08 y 04
I have learned many skills through HES and am very grateful for the education I have received at FSU. I enjoy my job very much & am thankful to my instructors for their efforts.

05 07 01 y 07
Speaking from the trucking industry standpoint, more time should be spent on P.M. The P.M. mechanic can save or break a company because he is the one who sees the trucks most often and knows their condition best. He is the jack-of-all-trades, must know some of every part of the truck so as to spot trouble areas and repair if small. I feel he is and should be the most knowledgeable mechanic in the shop. I was one for 3 yrs and spotted stuff on trucks the specialists (engine man, trans man) didn't see, as they were knowledgeable in their specialized area only.

05 07 01 y 07
You have a very good program. The instructors are very knowledgeable and helpful. Keep up the good work.

07 02 01 y 01
Most of the in-class courses were generally covered fairly well for the college student, but more emphasis needs to be placed on the service floor area in terms of volume to better prepare the student for the REAL world when he gets a job. Some students took 6 to 8 weeks to complete a diesel engine overhaul which is indeed thorough but much too slow to prepare a person for the work force.

APPENDIX XXXXIV

COMMENTS BY GRADUATES WITH ADDITIONAL DEGREES

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In Bu Jo A TY                  Comments
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09 02 04 y 04
   I am presently working in the medical field as a service
   tech & have also worked in industry as a robotics tech.
   The mechanical skill I have learned at Ferris I apply
   daily to my present position.

10 10 01 y 05
   FSU must strive to teach the basics well, what I mean by
   basics are operation principles & theories in the proper
   maintenance practices of equipment.  Keep the teaching &
   text materials simple & straightforward.  Prior to my
   enrolling into HES back in June, 79, I had really no prior
   work experience as a hands-on mechanic.  No experience
   following directions & fabricating things.  My first job
   with GSI after graduation-85% fabrication work & 15% of
   what I went to school for.  I felt overwhelmed & at a great
   disadvantage.  I would change the welding 20 wk requirement
   somewhat to insure 8 wks of practical fabrication time.
   I'd have geared to what a journeyman may encounter on the
   job.  This would give an edge to those with no practical
   experience.

10 16 05 y 07
   I did not work in the Heavy Equipment field after graduation.
   Perhaps, a question along these lines is in order.

15 02 27 y 06
   Please have someone contact me if I could assist in any
   way with possible improvements for the program.

16 02 27 y 03
   I am no longer in the HE or automotive field but my
   education from Ferris opened the door to my present position.
   I am working as a Stationary Engineer in a power house and
   am presently taking classes at JC in GR to obtain my State
   License.  I operate a waste boiler and 2 package boilers
   each rated at 20,000 lbs of steam per hour.  We also are
   a co-generation plant and produce as much as 500kw/hr.
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COMMENTS BY GRADUATES WITH ADDITIONAL DEGREES

In Bu Jo A TY Comments
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Our plant also runs two 150 hp air compressors with several smaller backup units. If I can help the HE program any further please contact me.

17 27 27 y 01

Eventhough I do not work in a HES field, I find a use for my practical education on a daily basis. One of my responsibilities as a Logistics Engineer is to provide inputs to design engineers to ensure the equipment is maintainable. As you can imagine, a practical philosophy on design concepts is important input to the service technician in the military ranks.

17 43 01 y 02

This survey is very hard for military personnel on active duty to fill out, as most of the areas do not conform to our military occupational skills areas if we are working out of a motor pool, or a rebuild area. I work with heavy armament on tanks and self propelled howitzers. I deal mainly with the "black boxes", which is electronics as well as the hydraulics that do the actual work. Thank you for the opportunity to fill out this survey and I hope that at least in some small way it helps.

17 43 05 y 03

I am now a helicopter pilot in the US marine corps. I still utilize my training from HES. It was helpful in flight school while going through electrical, hydraulic & power-plant systems.

17 43 39 y 03

I really enjoy flying. I fly the E-ZC Hawkeye from the aircraft carrier "USS Enterprise." I don't know if I'll ever work in the automotive industry, but if I do, I'll be sure to fill out this survey more completely.

17 43 39 y 05

Sorry I can't help more. I've been a pilot for the United States Marine Corps since 1983.

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COMMENTS BY GRADUATES WITH ADDITIONAL DEGREES

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In Bu Jo A TY                 Comments
== == == = == ==============================================
18 27 27 y 03
   Please send me a current course/program outline for HES
   and AHT.

19 02 32 y 01
   I am now working in a chemical plant.  The job before this
   one - generator sets, which is fieldwork usually by yourself.
   A week or so on rigging is needed for moving heavy parts
   safely.  Safety should be stressed.

19 06 05 y 03
   I have recently started working for Consumers Power Co.
   and I am presently working in the Grand Rapids area.

26 02 04 y 03
   The skills I rely on the most are the ones I learned thru
   the AHM program.  However, I am required to troubleshoot over
   the phone to our dealers,  which is very difficult.  I'm
   not familiar with changes in the HES curriculum since '81,
   but I feel a more concentrated effort in teaching tblshooting
   will not only help HES grads who become technicians, but it
   will also help those who go on to AHM & a career as a
   factory service, parts, or even sales rep.  The nuts & bolts
   background we received at Ferris gives us a big advantage
   over others who have not had the technical training.  Others
   who compete for the same jobs don't seem to have as strong a
   technical background.  If FSC  provided a little more
   troubleshooting experience, it will give our grads an
   advantage that will be difficult for anyone else to match.
   Keep up the good work!

30 01 01 y 07
   You have two instructors that I would not recommend to teach
   anyone.  If I were a Ferris staff I would not admit that I
   even knew them.
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APPENDIX XXXXV

COMMENTS ON THE EIGHT SURVEYS THAT WERE DISCARDED

Comments

x I received your questionnaire and regret to tell you I have not worked in the field as yet. Sorry I can't be of help to you at this time. (Survey not returned)

x Dear sir:
I suggest you research my records, I graduated with an A.A.S. in "79-80" Architectural Drafting Tech. I'm sorry, I can't participate in your Automotive and Heavy Equipment survey. Thank You.

x Gentlemen:
This survey was sent in error as I did not participate in Heavy Equipment Service.

x I got hurt on the job, so I'm not able to work in the Heavy Equipment Field.

x The teachers should grade according to how much work you accomplish on the service floor and how good of a job you do. I earned a B+ on the service floor, and just because I over tightened some bolts on accident, I got my grade lowered to a C. I will never forget that and I will NEVER recommend Ferris with a high status to someone to go there for a HE degree. I would tell them to attend Ohio Diesel where you get graded fairly, not unfairly!

x My son is presently employed as an auto mechanic (dealership) in Rose City, MI. He never worked in Heavy Equipment. (His Mom)

x I was a transfer student into the AHM [AHT] program. I did not attend the Ferris Heavy Equipment Service program.

x NOTE: This survey was returned unanswered.

APPENDIX B

Ferris State University
Heavy Equipment Service Program
Survey of Associate's Degree Graduates

1. Where are you currently employed? Name: ______________________________
   Address: ______________________________

2. How long have you been employed there? __________

3. What is your present position/job title? ______________________________

4. What was your starting salary? $__________

5. What is your present salary? $__________

6. Was it difficult to find a job when you graduated? Yes ___ No ___

7. How soon after graduation did you find work in the heavy equipment field? ______

8. What non-heavy equipment classes would have helped you be better prepared academically for the heavy equipment profession?

9. Which phase of your on-campus education was more valuable in preparing you for work?
   ____ heavy equipment courses ____ service floor

10. Based upon your heavy equipment course work at Ferris, were you able to obtain ASE/Michigan certification in all areas? Yes ___ No ___
    If not, please explain the area of concern.

11. How effective was your heavy equipment course work in preparing you for work? Should any changes be made?

12. To what degree do you feel a co-op experience or internship would have helped you in preparing for work?
100-90___
89-80___
79-70 ___
69-60___
59-50 ___
49-40 ___
39-30 ___
29-20 ___
19-10 ___
9-0 ___

13. Was the technological equipment used in your heavy equipment courses up to date?
Yes ___ No ___
Please explain:

14. How useful were the computers you used and the computer skills you developed in the Heavy Equipment Program? Please explain:

15. If you were to return to school for a Bachelor's Degree, would you consider Ferris?
Yes ___ No ___

Please explain:

16. What areas of heavy equipment do you think the FSU program needs to more thoroughly address?

17. Would you recommend this program? Yes ___ No ___ Please explain:

Dear "First Name,"

The enclosed survey has been developed as directed by Ferris State University to fulfill a full review of the Heavy Equipment Technology A.A.S. degree program. A review is required of all University programs on a cyclical basis. The Heavy Equipment Technology faculty and administration have embraced the review as our chance to determine if the program is fulfilling its purpose.

Your timely contribution is requested in completing this survey and is most important to us. Your answers will impact the program affecting changes we might see as needed for improvement. Continued program success through improvement is the goal of the review. Please allow us to use some of your valuable time to complete this survey along with any comments you wish to contribute.

Your continued support of the Heavy Equipment Technology Program at FSU is greatly appreciated. If you have any questions, please call 616/592-2810. This survey is for the A.A.S. degree program, and we would like it returned to us by **April 7, 1998.** You can return the completed survey in the enclosed, self-addressed, postage-paid envelope or fax to 616/592-2812.

Sincerely,

William T. Hillary, Professor
Heavy Equipment Technology

WH/ds

Enclosure

A.A.S. Alumni

APPENDIX C

Ferris State University
Heavy Equipment Service Engineering Program
Survey of Bachelor's Degree Graduates

1. Where are you currently employed? Name: ______________________
   Address: ______________________

2. How long have you been employed there? __________

3. What is your present position/job title? ______________________

4. What was your starting salary? $__________

5. What is your present salary? $__________

6. Was it difficult to find a job when you graduated? Yes ___ No___

7. How soon after graduation did you find work in the heavy equipment field? ________

8. What non-heavy equipment classes would have helped you be better prepared academically for the heavy equipment profession?

9. Which phase of your on-campus education was more valuable in preparing you for work?
   ____ heavy equipment courses ____ internship

10. Based upon your heavy equipment course work at Ferris, were you able to obtain ASE/Michigan certification in all areas? Yes ___ No ___
    If not, please explain the area of concern.

11. How effective was your heavy equipment course work in preparing you for work?

Should any changes be made?

12. To what degree do you feel your internship helped you in preparing for work?
100-90___
89-80___
79-70___
69-60___
59-50___
49-40___
39-30___
29-20___
19-10___
9-0 ___

13. Was the technological equipment used in your heavy equipment courses up to date?
Yes ___ No ___
Please explain:

14. How useful were the computers you used and the computer skills you developed in the Heavy Equipment Program? Please explain:

15. What areas of heavy equipment do you think the FSU program needs to more thoroughly address?

16. Would you recommend this program? Yes___ No ___ Please explain:

17. If you had it to do over, would you complete this Bachelor's Degree Program?
Yes___ No ___ Please explain:

Dear "First Name,"

The enclosed survey has been developed as directed by Ferris State University to fulfill a full review of the Heavy Equipment Technology A.A.S. degree program. A review is required of all University programs on a cyclical basis. The Heavy Equipment Technology faculty and administration have embraced the review as our chance to determine if the program is fulfilling its purpose.

Your timely contribution is requested in completing this survey and is most important to us. Your answers will impact the program affecting changes we might see as needed for improvement. Continued program success through improvement is the goal of the review. Please allow us to use some of your valuable time to complete this survey along with any comments you wish to contribute.

Your continued support of the Heavy Equipment Technology Program at FSU is greatly appreciated. If you have any questions, please call 616/592-2810. This survey is for the A.A.S. degree program, and we would like it returned to us by **April 7, 1998.** You can return the completed survey in the enclosed, self-addressed, postage-paid envelope or fax to 616/592-2812.

Sincerely,

William T. Hillary, Professor
Heavy Equipment Technology

WH/ds

Enclosure

B.S. Alumni

Removed: List of surveyed graduates

APPENDIX F
STUDENT SURVEY
(AAS Degree)

How many semesters in the Heavy Equipment program have you currently completed?   1st 2nd 3rd 4th other

What prompted your interested in the Ferris State University Heavy Equipment Program? Check all that apply.

____ Counselor   ____ Parent(s)   ____ Friend(s)

____ Teacher(s)   ____ Advertisement(s)   ____ Co-worker at job

____ Technician of the Future day   ____ Other:__________

____

What are your plans or goals after completing your AAS degree?

____ Work Where: ______________________________

____ Further education

____ Work and education

____ Other ______________________________

How would you best describe the value of subject matter covered of the following classes?

HEQT 100 Trouble-Shooting Strategies: [] Have not taken

[] Excellent [] Good [] Fair [] Poor [] Very Poor

Comments:______________________________

HEQT 101 H.E. Maintenance Fundamentals: [] Have not taken

[] Excellent [] Good [] Fair [] Poor [] Very Poor

Comments:______________________________

HEQT 110 H.E. Electronics Fundamentals: [] Have not taken

[] Excellent [] Good [] Fair [] Poor [] Very Poor

Comments:____

HEQT 120 H.E. Engine Technology: [] Have not taken

[] Excellent [] Good [] Fair [] Poor [] Very Poor

Comments:____

HEQT 160 Fluid Power Fundamentals: [] Have not taken

[] Excellent [] Good [] Fair [] Poor [] Very Poor

Comments:____

HEQT 200 Planned Maintenance Systems: [] Have not taken

[] Excellent [] Good [] Fair [] Poor [] Very Poor

Comments:____

HEQT 201 Transport Refrigeration: [] Have not taken

[] Excellent [] Good [] Fair [] Poor [] Very Poor

Comments:____

HEQT 210 Heavy Equipment Electrical Systems: [] Have not taken

[] Excellent [] Good [] Fair [] Poor [] Very Poor

Comments:____

HEQT 230 Diesel Fuel Systems Technology: [] Have not taken

[] Excellent [] Good [] Fair [] Poor [] Very Poor

Comments:____

HEQT 240 H.E. Brakes & Suspension systems: [] Have not taken

[] Excellent [] Good [] Fair [] Poor [] Very Poor

Comments: ______________________________

HEQT 270 H.E. Power Transfer Technology: [] Have not taken

[] Excellent [] Good [] Fair [] Poor [] Very Poor

Comments: ______________________________

HEQT 275 Heavy Equipment Lab Practice: [] Have not taken

[] Excellent [] Good [] Fair [] Poor [] Very Poor

Comments: ______________________________

The following questions are an over-all summary of the Heavy Equipment Program.

How would you describe the time used in the Heavy Equipment classes?

[] Excellent [] Good [] Fair [] Poor [] Very Poor

Comments: ______________________________

The teachers' knowledge on the material presented was:

[] Excellent [] Good [] Fair [] Poor [] Very Poor

Comments: ______________________________

The teachers' availability, helpfulness and courtesy were:

[] Excellent [] Good [] Fair [] Poor [] Very Poor

Comments: ______________________________

The facilities overall appearance and set-up are:

[] Excellent [] Good [] Fair [] Poor [] Very Poor

Comments: ________________________________

How were your course lab experiences?

[] Excellent [] Good [] Fair [] Poor [] Very Poor

Comments: ________________________________

The availability of shop tools are:

[] Excellent [] Good [] Fair [] Poor [] Very Poor

Comments: ________________________________

The experiences on the service floor are: [] Have not taken

[] Excellent [] Good [] Fair [] Poor [] Very Poor

Comments: ________________________________

Do you feel the tool requirement is adequate

[] Excellent [] Good [] Fair [] Poor [] Very Poor

Comments: ________________________________

Do you feel the classes are sequenced properly: ____________

____

____

What are two important changes you would make to improve the Heavy Equipment Program:

1) ____

2) ____

Additional comments on any other matter related to assessing your education at Ferris State University? ________________

____

____

APPENDIX G

Student Survey

(BS Degree)

How many semesters in the Heavy Equipment program have you completed in currently? 5th 6th 7th 8th other

What prompted your interest to continue with your education? Please check all that apply.

____ Teacher(s) ____ Parent(s) ____ Friend(s)

____ Career advancement ____ Advertisement ____ Co-worker on job

____ Other: ____

____

How would you best describe the amount of subject matter covered of the following classes?

HSET 370 H.E. Automatic Transmissions: [] Have not taken

[] Excellent [] Good [] Fair [] Poor [] Very Poor

Comments: ____

HSET 393 Industry Internship: [] Have not taken

[] Excellent [] Good [] Fair [] Poor [] Very Poor

Comments: ____

HSET 400 Failure Analysis: [] Have not taken

[] Excellent [] Good [] Fair [] Poor [] Very Poor

Comments: ____

HSET 401 Interfacing systems: [] Have not taken

[] Excellent [] Good [] Fair [] Poor [] Very Poor

Comments: ______________________________

HSET 402 Fleet Management: [] Have not taken

[] Excellent [] Good [] Fair [] Poor [] Very Poor

Comments: ______________________________

HSET 460 H.E. Adv. Hydraulic Systems: [] Have not taken

[] Excellent [] Good [] Fair [] Poor [] Very Poor

Comments: ______________________________

HSET 403 Testing and Systems Analysis: [] Have not taken

[] Excellent [] Good [] Fair [] Poor [] Very Poor

Comments: ______________________________

The following questions are an over-all summary of the Heavy Equipment Program.

How do the technical related classes conform with the program goals of preparing you to be an H.E. technician.

[] Excellent [] Good [] Fair [] Poor [] Very Poor

Comments: ______________________________

Do you feel the classes are sequenced properly? ____________

____

____

What are two things you would change in this program? _______

1) ____

2) ____

Additional comments on any other matter related to assessing your education at Ferris State University? ________________

____

____

Heavy Equipment Technology,
Heavy Equipment Service Engineering Technology

APRC 1998-1999

Section 6 of 8

Electrical Power Generation Certificate Classes

Were the certificate classes offered or presented to you?
YES NO

Did you take any certificate classes? YES NO

How beneficial are the certificate classes?

[] Excellent [] Good [] Fair [] Poor [] Very Poor

Comments:____

How helpful was the material in the certificate classes?

[] Excellent [] Good [] Fair [] Poor [] Very Poor

Comments:____

How adequate was the equipment to work with?

[] Excellent [] Good [] Fair [] Poor [] Very Poor

Comments:____

What are two things you would change in the certificate classes?

1) ____

2) ____

APPENDIX H

SURVEY
of

FERRIS STATE UNIVERSITY
HEAVY EQUIPMENT TECHNOLOGY AAS DEGREE PROGRAM

by
HEAVY EQUIPMENT TECHNOLOGY ADVISORY BOARD

for

1998 ACADEMIC PROGRAM REVIEW

A. INSTRUCTIONS to advisory board member:

Please mark the appropriate box for each question and write in any comments you wish to add under each question. Please feel free to add any additional comments on a separate sheet of paper. Return the survey in the self addressed envelope. It is important that all the questions are answered and the survey returned as soon as possible. Another survey asking questions for BS degree program in Heavy Equipment Service Engineering Technology will sent in a few days. Thank you for your continued support in this endeavor to improve Ferris States Heavy Equipment program.

A rating of 1 means that you strongly agree with the question.
A rating of 2 means that you agree with the question.
A rating of 3 means that you disagree with the question.
A rating of 4 means that you strongly disagree with the question.
A rating of 5 means that you are not sure or the question does not apply.

Question	1	2	3	4	5
1. The Heavy Equipment Technology program provides students with practical skills and knowledge experiences. Comments: ______					
2. The Heavy Equipment Technology program Advisory Board meets often enough. Comments: ______					
3. The communication/advising link between FSU HET program and its Advisory Board is adequate? Comments: ______					
4. The Heavy Equipment Technology AAS degree program is periodically reviewed and revised to keep current with changing job practices and technology. Comments: ______					
5. As a member of the Board, you are knowledgeable about the Heavy Equipment Technology program. Comments: ______					
6. Employment prospects for Heavy Equipment Technology graduates are favorable upon completion of the program. Comments: ______					

advcom/aas/

	1	2	3	4	5
7. The physical facilities are sufficient to support quality instruction. Comments:______					
8. Instructional equipment used is current and representative of what graduates will use on the job. Comments: ______					
9. Computers will become more prominent in all aspects of the heavy equipment repair industry. Comments: ______					
10. Classes are reviewed and revised to keep current with the changing job practices and technology. Comments: ______					
11. The Advisory Board is adequately utilized by the program. Comments: ______					
12. Short and long term employment prospects in the industry remain strong. Comments: ______					
13. Suggestions from the Advisory Board members are encouraged and adopted by the program. Comments: ______					

14. What are the major strengths of the program? ______

15. What are your suggestions for improvement of the Heavy Equipment AAS degree program ? ______

Additional comments: ______

Please indicate what area of the heavy equipment industry you work in. If you work in more than one area, indicate the percentage in each area.

CONSTRUCTION	AGRICULTURE	TRUCKING
☐%	☐%	☐%

THE FOLLOWING QUESTIONS ARE RELATED TO THE POWER GENERATION CERTIFICATE OPTION THAT IS OFFERED IN ADDITION TO THE AAS DEGREE!	1	2	3	4	5
1. The Power Generation option provides learning in a need area of the heavy equipment industry ? Comments:__________					
2. The employment prospects for Power Generation option holders is strong. Comments:__________					
3. The Power Generation option should be continued as a certificate option in addition to The Heavy Equipment AAS program. Comments:__________					
4. Additional comments about the Electrical Power Generation certificate option.					

APPENDIX I

SURVEY

of

FERRIS STATE UNIVERSITY
HEAVY EQUIPMENT SERVICE ENGINEERING TECHNOLOGY
BS DEGREE PROGRAM

by

HEAVY EQUIPMENT TECHNOLOGY ADVISORY BOARD

for

1998 ACADEMIC PROGRAM REVIEW

A. INSTRUCTIONS to advisory board member:

Please mark the appropriate box for each question and write in any comments under each question. Please feel free to add any additional comments on a separate sheet of paper. Return the survey in the self addressed envelope. It is important that all the questions are answered and the survey returned as soon as possible. There are two sections to the survey. The first eleven are questions relating to both the Maintenance and Manufacturing options. Questions twelve and thirteen relate to the Manufacturing option only. Questions fourteen and fifteen relate to the Maintenance option only.

A rating of 1 means that you strongly agree with the question.
A rating of 2 means that you agree with the question.
A rating of 3 means that you disagree with the question.
A rating of 4 means that you strongly disagree with the question.
A rating of 5 means that you are not sure or the question does not apply.

	1	2	3	4	5
1. The Heavy Equipment Service Engineering Technology program provides students with practical skills and knowledge experiences. Comments:____________					
2. The Advisory Board members are knowledgeable about the Heavy Equipment Service Engineering Technology program. Comments:____________					
3. Employment prospects for Heavy Equipment Service Engineering Technology graduates are favorable upon completion of the program. Comments:____________					
4. The physical facilities are sufficient to support quality instruction. Comments:____________					
5. Instructional equipment used is current and representative of what graduates will use on the job. Comments:____________					

	1	2	3	4	5
6. Classes are reviewed and revised to keep current with the changing job practices and technology. Comments:____________________					
7. The Advisory Board is adequately utilized by the program. Comments: ____________________					
8. Short and long term employment prospects remain strong. Comments: ____________________					
9. Suggestions from the Advisory Board members are encouraged and adopted by the program. Comments: ____________________					
10. What are the major strengths of the program? ____________________ 11. What are your suggestions for improvement of the Heavy Equipment Service Engineering Technology degree program ? ____________________ 12. The Manufacturing option provides employment opportunities for graduates to enter the manufacturing / engineering technology side of the heavy equipment repair industry. Comments:____________________					
13. The courses offered in the Manufacturing option provide adequate preparation for entering the field. Comments:____________________					
14. The Maintenance/Repair option provides employment opportunities for graduates to enter the heavy equipment maintenance management/repair industry. Comments:____________________					
15. The courses offered in the Maintenance option provide adequate preparation for entering the field. Comments:____________________					
Additional comments:____________________					

A STUDY
TO DETERMINE THE EDUCATIONAL AND TRAINING NEEDS
OF THE HEAVY EQUIPMENT INDUSTRY

Presented to
The Administration and Faculty
Ferris State University

To Provide Data for
Curriculum Development and Planning

Presented by the
Program Curriculum Committee
and Program Director
Heavy Equipment Technology
October 1990

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The curriculum committee would like to thank the Heavy Equipment Center team for their support of this project. Special thanks go out to those who made comments and/or suggestions, typed, assisted with the mailings, and helped in other ways too numerous to mention.

The Office of Assessment Services at Ferris State University gave advice on the development of the survey instrument, data collection and management procedures. The assistance given by Manfred Swartz and Linda Burnes is deeply appreciated.

The committee also would like to thank those students who gave of their time to help with the survey mailings.

The committee extends its appreciation to the University, School of Technology, and the Automotive and Heavy Equipment Department for the financial and human resources made available for this study.

The writers would like to give special thanks to Herbert G. Nicholson, Program Director for the Heavy Equipment Technology Program, for his encouragement, suggestions, comments, commitment, and tenacity.

PREFACE

The Heavy Equipment Technology Curriculum Committee Members

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Bruce W. Jacobs	John A. Strohkirch

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Writing of Final Document	Kenny R. Acton Bruce W. Jacobs
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SECTION 1

INTRODUCTION TO THE STUDY

Introduction To The Problem

The heavy equipment industry is comprised of several dynamic diversified parts which are being affected in many different ways, and at different rates, by expanding technology. This expansion ranges from the application of electronics and computers to manage and control mechanical and hydraulic systems, to the application of fiber optics in electrical and electronic systems. The industry faces a major problem created by a critical shortage of qualified practicing technicians to maintain and repair these sophisticated systems.

How will this shortage of qualified technicians be addressed? One source might be the retraining of mechanics currently working in the industry. However, many companies have already found that a large percentage of practicing mechanics do not possess the required educational foundation to understand these more complex technical systems. Can industry build the required educational foundation and train for the new technology at the same time? Probably not! This, coupled with the fact that the industry will be faced with a shortage of up to 100,000 technicians by the year 2000[1] further emphasizes the seriousness of the problem.

Another source will be for education and training sources to prepare a more sophisticated technician for entry into the workforce. Traditionally, public and private schools, dealership and factory training, and apprenticeship programs have been able to provide the education and training needed to meet industry job requirements. However, the expansion of technology is seriously affecting the ability of these sources to deliver an acceptable end product without a dramatic increase in education and training time. Obsolete skills and knowledge cannot be removed from existing vocational and technical curriculums...to make room for new curriculum...at the same rate new skills and knowledge must be added to address the requirements of new technology. In addition, an expanded theoretical foundation, upon which current technical concepts are built, must be implemented into curriculums.

Purpose of the Study

This study was designed, as a national study, to collect data from the trucking, construction, agricultural, mining, oil field, utilities, government, military, defense, marine, mobile

[1] Silvestri, George T. and Lukasiewicz, John M., Bureau of Labor Statistics; "Projections 2000," Monthly Labor Review, Vol. 110, No. 9. September, 1987, 54.

refrigeration, standby power generation, material handling, forestry, air transportation, bus transportation, and railroad transportation industries to:

1. Determine the market strength for a graduate from a BS degree program in heavy equipment service technology.

2. Identify the most important subject matter areas that must be taught to students enrolled in heavy equipment technology programs to prepare them to meet current and future job requirements. Subject matter areas included technical, technical support, English, humanities, behavorial science, and natural science.

3. Determine the upgrade training needs of practicing heavy equipment mechanics.

4. Identify the direction the Heavy Equipment Technology Program at Ferris State University should take in upgrading its curriculum, and in providing education and training services to practicing mechanics within the field.

Statement of Problem

The technical expansion of the heavy equipment industry is occurring at such a rapid rate that industry and educational institutions are having difficulty fulfilling the training requirements within the current established time restraints. Much of this expansion is occurring in areas where the current mechanic lacks the basic foundation knowledge for retraining. In addition, the heavy equipment industry will face an estimated shortage of up to 100,000 technicians by the year 2000.[2]

Research Questions

1. Is there a need for a graduate with a bachelor of science degree in heavy equipment technology (HET)?

2. How many heavy equipment technology bachelor degree graduates are needed currently, in five years, and in ten years?

3. What subject matter areas are most important to the various industries within the heavy equipment industry?

4. How does the demand for subject matter listed in the HET technical areas compare to the demand for those listed as technical support and general education?

5. What are the most critical needs for updating and retraining the current heavy equipment industry workforce?

[2] Silvestri and Lukasiewicz, 87.

6. What training sources will be used to update the current heavy equipment industry workforce?

Definition of Terms

Heavy Equipment Industry: For the purpose of this study the heavy equipment industry is defined as the trucking, construction, agricultural, mining, oil field, utilities, government, military, defense, marine, mobile refrigeration, standby power generation, material handling, forestry, air transportation, bus transportation, and railroad transportation industries.

General Education Courses: Arts and science courses that are important for establishing foundation knowledge. This knowledge forms the theoretical base from which technical concepts are developed. They also develop communication skills and provide a better understanding of the society in which we live.

Technical Support Courses: Courses that are very specific in nature and are parts of other programs of specialization. They are usually business, management, or engineering related.

Technical Courses: Courses that are technical in nature and are necessary for the troubleshooting and repair of the machines or equipment used in the heavy equipment industry.

Subject Matter Area: A specific area of knowledge that was thought to be potentially important for a Bachelor of Science graduate of a Heavy Equipment Technology Program to possess. It is important that they are not interpreted as being a specific course. However, they may be a part of a course, a full course, or several courses. Question VI on the survey instrument contains the listing of these subject matter areas. See Appendix I for a copy of the complete survey instrument.

Rated Subject Matter Areas: The rating of the subject matter areas was accomplished by taking the average of all circled responses for each subject matter area in Question VI of the survey instrument and applying them to a modified Lickert scale.

Ranked Subject Matter Areas: Those subject matter areas that the respondents indicated as being important enough to be ranked in one of the top ten positions in Question VII, or the top five positions in Question X, on the survey instrument.

Delimitations of the Study

From the onset of this project, an attempt was made to solicit information from the industries specified in the Definition of Terms, and which are a part of the overall heavy equipment industry. A major source for identifying those specific industries which were chosen was a previous alumni follow-up of Ferris State University graduates of the present Associates Degree program in Heavy Equipment Service.

Information was solicited on a national basis. This decision was made to specifically eliminate any bias in the technical section of the survey which could have been created by terrain, duty cycle, or operational parameters that may be unique to a particular area.

Limitations of the Study

This study was designed to be as representative of the heavy equipment industry as possible. However, the reader must be aware of the following limitations in the interpretation of its results.

Industry Classification: Question II on the survey instrument was set up to allow the respondent to select more than one industry which they served. The industry that received the highest percentage rating was selected as the industry classification for that respondent's business. In 36, or 9.1%, of the returns this procedure changed the initial industry classification that was initially assigned to the respondent.

Survey Population: Mailing lists for the various heavy equipment industries were not equally accessible. Therefore, those industries that had an abundance of names were limited, by a random selection process, in order to prevent any one industry from dominating the study.

Need for Graduates: The need for graduates is based upon a graduate with a Bachelor of Science Degree in Service Technology, as described in the introduction to the survey instrument (Appendix I). This question was specifically asked in Question VIII on the survey instrument.

Number of Graduates Needed: Question IX on the survey instrument addressed this subject. However, due to the wording of this question, it is not clear whether the respondents interpreted the question as meaning their total needs or additional needs for the five and ten year time periods. As a conservative estimate for curriculum planning, the writers have interpreted the number of graduates needed in five years and ten years as being the total numbers. Therefore, the number indicated for five years includes also the immediate needs. Likewise, the number indicated for ten years includes both the immediate and five year needs. If the reader wishes to interpret the data as additional, then the demands for the four year graduate will be considerably higher than the writers' interpretation.

SECTION 2

RESEARCH PROCEDURES

DEVELOPMENT OF THE SURVEY INSTRUMENT

The survey instrument was designed so that as much information as possible could be identified and correlated back to the respondent's industry and business type. Appendix I contains a copy of the survey instrument that was used in this study.

Question II of the instrument was set up on a percentage response rather than having the respondent make a single choice. Using this method allowed the respondent the opportunity to best represent the primary market they serve, and at the same time eliminate the potential loss of valuable information if more than one market was checked using a single choice check-off method.

Question VI was set up to establish the industries' opinions of the degree of importance between the different subject matter areas. The method of soliciting this data differed in opinion between the instrument designers and thereby generated the need for two different pilot samples. One pilot asked that <u>all</u> the subject matter areas in the question be ranked by importance, and the other pilot contained a modified four point Likert scale.

Question VII and X were set up as rankings in order to establish the importance of the various subject matter area by industry.

SAMPLE AND POPULATION

Forty survey instruments were sent out as a pilot sample to determine the most appropriate instrument to send to the total study population. The pilot population was comprised of the members of the Ferris State University Heavy Equipment Advisory Committee and select members of various industry associations. Twenty-two of the pilots were returned for an overall return rate of 55%. The results were overwhelming in support of the modified Likert scale. The final instrument was a slightly modified version which incorporated many of the changes that were suggested by the respondents of the pilot population.

The overall population of the survey was compiled from many different sources. We would like to thank those individuals and organizations who assisted us with information, lists, and mailing assistance. The response was so great that the number of names and addresses had to be limited so that the survey population would comply with industry, type of business, and geographic parameters established by the study committee.

In the combining of the many different mailing lists used to obtain the survey population, it was discovered that there were several duplications of companies. The final mailing list was purged of these duplicate records. A concerted effort was made to establish good representation from each industry, type of business, and geographic location.

The final study population was generated from the following lists:

"List 1"
"Manufacturer Listings; 1990 Buyers Guide." Construction Equipment, 30 November 1989: 254 - 320

"List 2"
"Directory of Membership 1988-1989." Equipment Maintenance Council

"List 3"
"Mailing List." Equipment Manufacturers Institute

"List 4"
Official Motor Directory, Inc. Official Motor Carrier Directory 1989 Issue 111.

"List 5"
Diesel & Gas Turbine Publications. 1989 Diesel & Gas Turbine Catalog Worldwide Engine Power Products Directory and Buyers Guide: Vol. 54. Wisconsin: Diesel & Gas Turbine Publications., 1989

"List 6"
"Mailing List." Michigan Equipment Dealers Association.

"List 7"
"Directory." Wisconsin Farm Equipment Association, Inc.

"List 8"
Selected Agricultural Dealers from Northwestern Ohio (Various Sources).

"List 9"
"1990 Buyers' Guide & Member Services Directory." Electrical Generating Systems Association. N.p.: Diesel & Gas Turbine Publications

"List 10"
"1988-1989 Membership Roster & Product Directory." National Truck Equipment Association. N.p.: Tescorp

"List 11"
"CFS Buyers Guide 1990 Parts/Equipment & Services Directory." Council of Fleet Specialists

"List 12"
"Mailing List." Construction Industry Manufacturers Association.

"List 13"
"Directory." Industrial Truck Association

"List 14"
Thomas Regional Directory Co., Inc. Greater Michigan Regional Industrial Buying Guide 1990; Edition 8. New York: Thomas Publishing Co., 1990

"List 15"
"CE'S Industry Giants." Construction Equipment, 15 March 1988: 71+

"List 16"
"Mailing List." American Road Builders Association

"List 17"
"Directory." Indiana Implement Dealers Association.

"List 18"
"Mailing List." American Truck Dealers Association

"List 19"
"Mailing List." Associated Equipment Distributors
Associated Equipment Distributors 100

"List 20"
Thomas Publishing Co. Thomas Register of American Manufacturers Products and Services 1990; Volume 9, Paper Companies. N.p.: Thomas Publishing Co., 1990

"List 21"
Miscellaneous 4

Table 1 is a complete breakdown of the number of potential respondents selected from each list, and the percentage of respondents to the total population.

TABLE 1

ORIGIN OF FINAL MAILING LIST

	Number Selected From List	Percent of Total
List 1	138	5.8
List 2	137	5.7
List 3	25	1.0
List 4	349	14.6
List 5	78	3.3
List 6	71	1.5
List 7	80	5.1
List 8	37	1.5
List 9	122	5.1
List 10	57	2.4
List 11	64	2.7

	Number Selected From List	Percent of Total
List 12	83	3.5
List 13	34	1.4
List 14	239	10.0
List 15	418	17.4
List 16	117	4.9
List 17	104	4.3
List 18	128	5.3
List 19	100	4.2
List 20	11	0.5
List 21	4	0.2
TOTALS	2396	

Table 2 indicates the population distribution among the various industries and types of businesses within those industries. The top three industries were trucking (33.0%), construction (23.2%), and agricultural (11.8%). A similar type of industry distribution was found in the alumni follow-up study of our graduates from the Associate Degree in Heavy Equipment Service Technology. The most common types of businesses in the population were fleets (39.7%), dealerships (35.2%), and manufacturers (15.9%).

TABLE 2

MAILING LIST DISTRIBUTION BY INDUSTRY AND BUSINESS TYPE

Business Type

	C	D	F	I	M	P	R	T	%
Agri-cultural		259	7	4	12			282	11.8
Aviation		1	2					3	0.1
Buses/ Railroad		3	11					14	0.6
Con-struction	46	127	132	2	189	6	53	555	23.2
Engines		30			30	1		61	2.6
Forestry/ Paper		5	42	1	5	1		54	2.3
Generator Sets		80		1	22		3	106	4.4
Government	1	2	62		2			67	2.8
Hydraulic/ Pneumatic		1		1	5			7	0.3
Material Handling		14	1		38		2	55	2.3
Mining		3	173		6		1	183	7.6
Oil/ Chemical			11		3			14	0.6
Ships/ Marine		2	4		16			22	0.9
Trucking		309	351	3	36		91	790	33.0
Turbine Engines					9			9	0.4
Utility Companies		1	124	1	1			127	5.3
Waste Management			3			1		4	0.2
Other		6	28		6		3	43	1.8
TOTAL	47	843	951	13	380	9	153	2396	
%	2.0	35.2	39.7	0.6	15.9	0.4	6.4		

C = Consultant
D = Dealer/Distributor
F = Fleet
I = Independent Repair Shop
M = Manufacturer
P = Publisher
R = Rental/Lease
T = Total
% = Percentage of Total

Table 3 is a distribution of the survey population by zones.

TABLE 3

MAILING LIST DISTRIBUTION BY ZONE

	Number Selected From List	Percentage of Total
Zone 1	316	13.2
Zone 2	387	16.2
Zone 3	992	41.4
Zone 4	359	15.0
Zone 5	71	3.0

	Number Selected From List	Percentage of Total
Zone 6	159	6.6
Zone 7	3	0.1
Zone 8	9	0.4
Zone 9	100	4.2
TOTAL	2396	

"Zone 1"
Connecticut, Delaware, Massachusetts, Maine, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and New Brunswick.

"Zone 2"
Alabama, Washington DC, Florida, Georgia, Kentucky, Maryland, Missouri, Mississippi, North Carolina, Puerto Rico, South Carolina, Tennessee, Virginia, and West Virginia.

"Zone 3"
Illinois, Indiana, Michigan, Ohio, Wisconsin, and Ontario.

"Zone 4"
Arkansas, Iowa, Kansas, Louisiana, Minnesota, North Dakota, Nebraska, Oklahoma, South Dakota, Texas, and Manitoba.

"Zone 5"
Idaho, Montana, Oregon, Washington, Wyoming, Alberta, and British Columbia.

"Zone 6"
Arizona, California, Colorado, New Mexico, Nevada, Utah, and Mexico.

"Zone 7"
Alaska

"Zone 8"
Hawaii

"Zone 9"
The Associated Equipment Distributors assisted our efforts by mailing 100 surveys, at their expense, to selected association members. At the time we supplied the surveys to AED, we neglected to request a distribution by geographic area of the survey recipients. There, this group of surveys is included in its own zone for data analysis.

The complete population consisted of a total of 2396 potential respondents representing the various industries within the heavy equipment industry.

DATA COLLECTION

A cover letter (Appendix II), a coded questionnaire, and a postage paid return envelope (Appendix III) were sent to 2396 representatives of the heavy equipment industry on March 29, 1990. On April 26, 1990 a follow-up letter (Appendix IV), an additional follow-up coded survey questionnaire, and a postage paid envelope were sent to 1233 non-respondents of the first mailing. This partial follow-up was sent to all of the non-respondents in Zone 3 with the remainder being divided evenly among the other zones.

In addition to soliciting more respondents, the follow-up information was used to validate the data received from the initial first mailing responses. A comparison was made between the 270 first responses received by April 30, 1990 and the 95 responses from the follow-up survey which had been received by May 8, 1990. A total of 396 surveys were received from respondents by the cut off date of May 10th. In addition, 58 questionnaires were returned by the U.S. Postal Service as undeliverable. Therefore the total population was reduced by this amount making the final population of the study 2338. The final percentage of return was 396/2338 or 16.9%.

ANALYSIS OF DATA

The data from the survey questionnaires were analyzed on two different computer systems. A majority of the information that required intricate data comparison was analyzed on a "Statistical Package for Social Sciences" (S.P.S.S.) program on the University's IBM 3083 main frame computer. The population distribution and the need for graduates were analyzed on a Zenith personal computer using the "P.C. File Plus 3.0 " and "P.C. File Plus 5.0" database programs.

The analysis of data was conducted in three stages. First, a comparison was made of the overall distribution of the population with the distribution of the returns. The second stage was the validation process whereby the data received from the initial mailing was compared with the data on the follow-up mailing. The final stage was to address the research questions.

Many of the tables in the "Report of Findings" section of this report are condensed versions of the data found in the appendices following the table number. Since the tables only contain significant data, the reader may want to refer to the indicated appendix number if a complete listing of all the data is desired.

There was no comparison made of the business and industry distribution of the first mailing and the total returns. This information is not comparable because of the reclassification process that took place as described in the delimitation section of this report.

In comparing the importance of the subject matter areas, two methods of analysis were used. The first method was to establish how each of the 83 categories rated on a one to five scale...number one being very important and number five being those that were left blank and not applicable. The second method of determining the importance of the subject matter area was to compile a frequency count as to the number of times a specific area occurred in the top ten subjects listed in Question VII of the questionnaire. The latter method better establishes relative importance of the subject matter areas to each of the heavy equipment industries.

SECTION 3

REPORT OF FINDINGS

RETURN POPULATION

Table 4 is a summary of the return rates by list. The percent of return was calculated by first reducing the number selected by the number that was not deliverable, then the rate of return was calculated for each list. List Number 22 was added to provide a place for the completed questionnaires that were returned with the coded labels removed. The data is important to the overall survey, but which list it came from could not be determined. The overall goal was to attain a minimum of a 10% return. Table 4 indicates that fifteen of the twenty-one lists came in above that goal. For the convenience of the reader, identification of the various lists are included again in this section.

TABLE 4

PERCENTAGE OF SURVEY RETURNS BY LIST

	Number Selected From List	Number Undeliv-erable	Number Used in Calculation	Number of Completed Returns	Percent of Return
List 1	138	3	135	22	16.3
List 2	137	3	134	38	28.4
List 3	25	1	24	7	28.0
List 4	349	4	345	25	7.3
List 5	78	-	78	11	14.1
List 6	71	1	70	27	38.6
List 7	80	1	79	14	17.7
List 8	37	-	37	4	10.8
List 9	122	-	122	20	16.4
List 10	57	-	57	4	7.0
List 11	64	-	64	6	9.4
List 12	83	-	83	26	31.3
List 13	34	1	33	4	12.1
List 14	239	6	233	55	23.6
List 15	418	35	383	38	9.9
List 16	117	2	115	7	6.1
List 17	104	1	103	26	25.2
List 18	128	-	128	19	14.8
List 19	100	-	100	34	34.0
List 20	11	-	11	0	0
List 21	4	-	4	2	50.0
List 22		-	-	7	-
TOTALS	2396	58	2238	396	16.9

"List 1"
"Manufacturer Listings; 1990 Buyers Guide." Construction Equipment, 30 November 1989: 254 - 320

"List 2"
"Directory of Membership 1988-1989." Equipment Maintenance Council

"List 3"
"Mailing List." Equipment Manufacturers Institute

"List 4"
Official Motor Directory, Inc. Official Motor Carrier Directory 1989 Issue 111.

"List 5"
Diesel & Gas Turbine Publications. 1989 Diesel & Gas Turbine Catalog Worldwide Engine Power Products Directory and Buyers Guide: Vol. 54. Wisconsin: Diesel & Gas Turbine Publications., 1989

"List 6"
"Mailing List." Michigan Equipment Dealers Association.

"List 7"
"Directory." Wisconsin Farm Equipment Association, Inc.

"List 8"
Selected Agricultural Dealers from Northwestern Ohio (Various Sources).

"List 9"
"1990 Buyers' Guide & Member Services Directory." Electrical Generating Systems Association. N.p.: Diesel & Gas Turbine Publications

"List 10"
"1988-1989 Membership Roster & Product Directory." National Truck Equipment Association. N.p.: Tescorp

"List 11"
"CFS Buyers Guide 1990 Parts/Equipment & Services Directory." Council of Fleet Specialists

"List 12"
"Mailing List." Construction Industry Manufacturers Association.

"List 13"
"Directory." Industrial Truck Association

"List 14"
Thomas Regional Directory Co., Inc. Greater Michigan Regional Industrial Buying Guide 1990; Edition 8. New York: Thomas Publishing Co., 1990

"List 15"
"CE'S Industry Giants." Construction Equipment, 15 March 1988: 71+

"List 16"
"Mailing List." American Road Builders Association

"List 17"
"Directory." Indiana Implement Dealers Association.

"List 18"
"Mailing List." American Truck Dealers Association

"List 19"
"Mailing List." Associated Equipment Distributors
Associated Equipment Distributors 100

"List 20"
Thomas Publishing Co. Thomas Register of American Manufacturers Products and Services 1990; Volume 9, Paper Companies. N.p.: Thomas Publishing Co., 1990

"List 21"
Miscellaneous 4

"List 22"
Several surveys were returned with the coded identification labels removed. The responses from these surveys were used in the data analysis and are included in this list for the purpose of the totals.

Table 5 is a summary of the returns by zone. Zone 10 was added to process the responses of the surveys from which the coded identification label had been removed. In all but one zone, the goal of 10% was exceeded. It was also expected that zone three would be the highest because the potential respondents within that area would be the most familiar with Ferris State University and the existing Heavy Equipment Technology Programs. The identification of each zone is included again in this section for the readers convenience.

TABLE 5

MAILING LIST DISTRIBUTION BY ZONE

	Number Selected From List	Number Undeliv- erable	Number Used in Calculation	Number of Completed Returns	Percent of Return
Zone 1	316	13	303	36	11.9
Zone 2	387	12	375	34	9.1
Zone 3	992	19	973	219	22.5
Zone 4	359	8	351	44	12.5
Zone 5	71	3	68	7	10.3
Zone 6	159	3	156	17	10.9
Zone 7	3	-	3	1	33.3
Zone 8	9	-	9	1	11.1
Zone 9	100	-	100	34	34.0
Zone 10	-	-	-	3	-
TOTAL	2396	58	2338	396	16.9

"Zone 1"
Connecticut, Delaware, Massachusetts, Maine, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and New Brunswick.

"Zone 2"
Alabama, Washington DC, Florida, Georgia, Kentucky, Maryland, Missouri, Mississippi, North Carolina, Puerto Rico, South Carolina, Tennessee, Virginia, and West Virginia.

"Zone 3"
Illinois, Indiana, Michigan, Ohio, Wisconsin, and Ontario.

"Zone 4"
Arkansas, Iowa, Kansas, Louisiana, Minnesota, North Dakota, Nebraska, Oklahoma, South Dakota, Texas, and Manitoba.

"Zone 5"
Idaho, Montana, Oregon, Washington, Wyoming, Alberta, and British Columbia.

"Zone 6"
Arizona, California, Colorado, New Mexico, Nevada, Utah, and Mexico.

"Zone 7"
Alaska

"Zone 8"
Hawaii

"Zone 9"
The Associated Equipment Distributors assisted our efforts by mailing 100 surveys, at their expense, to selected association members. At the time we supplied the surveys to AED, we neglected to request a distribution by geographic area of the survey recipients. This group of surveys is included in its own zone for data analysis.

"Zone 10"
Respondent's geographic location unknown as a result of no postmark on envelope, and removed identification label on survey instrument.

Table 6 is a breakdown of the overall returns.

TABLE 6

SURVEY RESULTS

	Number Selected From List	Number Undeliverable	Number Used in Calculation	Number of Completed Returns	Percent of Return
First Mailing	2396	47	2349	291	12.4
Follow-up Miling	1233	11	1222	105	8.6
Total Mailings	2396	58	2338	396	16.9

Table 7 is a breakdown of the returns by industry.

TABLE 7

RETURN POPULATION BY INDUSTRY

Industry	% of Total
Construction	27.8
Trucking	21.7
Agriculture	17.7
Material Handling	6.6
Mining	5.6
Government	4.0
Utilities	2.5
Standby Power	2.5
Forestry	2.5
Bus Transportation	1.3
Others	5.2

Approximately two-thirds (67.2%) of all the returns came from three industries. The construction industry had the highest return rate of 27.8%. This was followed with a return of 21.7% for trucking, and a 17.7% return for agriculture.

Table 8 is a breakdown of returns by business type.

TABLE 8

RETURN POPULATION BY BUSINESS TYPE

Business Type	% of Total
Dealer/Distributor	45.2
Fleet	23.4
Manufacturer	20.3
Rental/Lease	5.1
Independent Repair	4.6
Other	1.4

Nearly 90% of the returns were from three business types. Dealer/Distributors accounted for 45.2% of the returns, fleets accounted for 23.4%, and manufacturers supplied 20.3% of the total.

Table 9 shows the distribution of the size of the businesses of the respondents that participated in the survey.

TABLE 9

RETURN POPULATION BY BUSINESS SIZE

Total Number of Employees	% of Total
< 10	10.7
11-49	29.5
50-99	16.3
100-249	12.2
250-499	9.7
> 500	21.6

The overall distribution was quite evenly spaced in the various size classifications. The largest category was from 11-49 employees accounting for 29.5% of the returns. The lowest was 9.7% for the 250-499 employees range.

Table 10 is the distribution of the return population by the number of their service/maintenance employees.

TABLE 10

RETURN POPULATION BY SERVICE/MAINTENANCE EMPLOYEES

Number Employees Service/Maintenance	% of Total
< 10	47.4
11-49	31.2
50-99	9.7
100-249	6.8
250-499	3.7
> 500	1.3

A majority of the population (78.6%) employed 50 or less as service/maintenance personnel.

STUDY VALIDATION

For the validation process, the returns from the initial mailing received by April 30 were compared to the follow-up returns received by May 8. Two hundred seventy initial returns were compared to 95 follow-up returns.

Table 11, which is a distribution of the initial mailing by industry and business type, and is the same as Table 2, is reproduced here for the convenience of comparison by the reader.

Table 12 is a distribution, by industry and type of business, in the follow-up survey. The ranking of the top three industries...trucking, construction, and agriculture... remained the same, and in the same order on both lists. The distribution of the top three businesses...fleets, dealerships, and manufacturers also remained the same, but the order switched slightly between the top two. Overall, the percentages of each industry and business remained relatively close on both lists. Therefore, there is a very positive correlation by industry and business types between the two mailings.

TABLE 11

INITIAL DISTRIBUTION BY INDUSTRY AND BUSINESS TYPE

Business Type

	C	D	F	I	M	P	R	T	%
Agri- cultural		259	7	4	12			282	11.8
Aviation		1	2					3	0.1
Buses/ Railroad		3	11					14	0.6
Con- struction	46	127	132	2	189	6	53	555	23.2
Engines		30			30	1		61	2.6
Forestry/ Paper		5	42	1	5	1		54	2.3
Generator Sets		80		1	22		3	106	4.4
Government	1	2	62		2			67	2.8
Hydraulic/ Pneumatic		1		1	5			7	0.3
Material Handling		14	1		38		2	55	2.3
Mining		3	173		6		1	183	7.6
Oil/ Chemical			11		3			14	0.6
Ships Marine		2	4		16			22	0.9
Trucking		309	351	3	36		91	790	33.0
Turbine Engines					9			9	0.4
Utility Companies		1	124	1	1			127	5.3
Waste Management			3			1		4	0.2
Other		6	28		6		3	43	1.8
TOTAL	47	843	951	13	380	9	153	2396	
% Total	2.0	35.2	39.7	0.6	15.9	0.4	6.4		

C = Consultant
D = Dealer/Distributor
F = Fleet
I = Independent Repair Shop
M = Manufacturer
P = Publisher
R = Rental/Lease
T = Total
% = Percentage of Total

TABLE 12

FOLLOW-UP DISTRIBUTION BY INDUSTRY AND BUSINESS TYPE

Business Type

	C	D	F	I	M	P	R	T	%
Agri-cultrual		216	2		4			222	18.0
Buses/ Railroad			5					5	0.4
Con-struction	20	24	88		101	2	23	258	20.9
Engines		15			18	1		34	2.8
Forestry/ Paper			14		3			17	1.4
Generator Sets		35			13		1	49	4.0
Govern-ment			24		1			25	2.0
Hydraulic/ Pneumatic					2			2	0.2
Material Handling		3			19		1	23	1.9
Mining			49		2			51	4.1
Oil/ Chemical			3		1			4	0.3
Ships/ Marine		1	3		12			16	1.3
Trucking		179	174		19		83	455	36.9
Utility Companies			50					50	4.1
Waste Management							1	1	0.1
Other		3	10		7		1	21	1.7
TOTAL	20	476	422	0	202	3	110	1233	
%	1.6	38.6	34.2	0.0	16.4	0.2	8.9		

C = Consultant
D = Dealer/Distributor
F = Fleet
I = Independent Repair Shop
M = Manufacturer
P = Publisher
R = Rental/Lease
T = Total
% = Percentage of Total

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Table 13 is a comparison of the return distribution by zones of the initial mailing list versus the distribution of the follow-up.

TABLE 13

PERCENTAGE OF SURVEY RETURNS BY ZONE

Zone Number	Initial % of Return	Follow-up % of Total
1	13.2	6.2
2	16.2	12.0
3	41.4	66.6
4	15.0	12.3
5	3.0	1.7
6	6.6	0.9
7	0.1	0.2
8	0.4	0.2
9	4.2	---

Zone 9 was from the Associated Equipment Distributors list of which no follow-up was attempted. A partial follow-up was made from the list of non-responders. All of the non-respondents in Zone 3 were sent follow-up questionnaires, therefore, increasing considerably the percentage of follow-up returns from that zone. The other zones received a smaller percentage of the follow-up, but all were represented.

With the correlation of business type, industry, and zone being closely related in the initial and follow-up groups, the next step was to compare the data of each. The research question addressed was: Will graduates with the indicated background be needed in the respondent's business? Table 14 is a comparison of the percentage of respondents to the initial and follow-up survey mailings.

TABLE 14

COMPARISON OF
PERCENTAGE OF RESPONSES INDICATING A NEED FOR GRADUATES

	% of Initial Responses				% of Follow-up Responses			
Needed ?	Yes	No	?	No Ans	Yes	No	?	No Ans
Presently	65.9	24.8	3.7	5.6	57.9	36.8	0	5.3
In 5 yrs	83.3	3.3	7.0	6.3	83.2	6.3	5.3	5.3
In 10 yrs	76.7	1.9	10.0	11.5	78.9	3.2	9.5	8.4

In comparing the data between needed presently, in five years, and in ten years, one can see that the pattern of increasing/decreasing percentages are very similar in both cases. Even though the percentages are not exactly the same, they are very close to each other. See Appendix V for the total frequency of responses for each of the groups.

The next question compared was: How many of the graduates will be needed in the industry? The correlation between the initial and follow-up respondents was derived from the frequencies of responses in Appendix VI. Table 15 is a comparison of the groupings of these responses.

TABLE 15

COMPARISON OF HOW NEEDS CHANGE WITH TIME

Presently Needed

	Initial %		Follow-up %	
No Answer	15.6	37.5	17.9	45.3
Need Zero	21.9		27.4	
Needs 1 to 10		60.6		51.7
TOTAL		98.1%		97.0%

Needed in Five Years

	Initial %		Follow-up %	
No Answer	17.0	18.9	17.9	20.0
Need Zero	1.9		2.1	
Needs 1 to 10		66.9		69.9
TOTAL		85.5%		89.6%

Needed in Ten Years

	Initial %		Follow-up %	
No Answer	25.2	25.2	24.2	24.2
Need Zero	0		0	
Needs 1 to 10		50.8		63.2
TOTAL		76.0%		87.4%

The pattern between the initial and follow-up studies are quite clear. The total percentage of those not responding to this question and those indicating a need of zero are high for present needs, drop in five years, and again increase in ten years. However, the percentage of respondents indicating a need of zero declines to zero in ten years. In comparing the total percentages, the trend in both the initial and follow-up studies is toward a lesser percentage with an increase in time period. Part of this decrease is caused by the increase in demands for more than 10 as the time increases.

The final area of comparison for the initial and follow-up studies is in that of the rankings of the most important subject matter areas. Appendix VII is a complete listing of all 83 subject matter areas listed on the survey instrument. The number represents the number of times that a particular subject matter area appeared in the top ten most important subjects in question number VII on the survey instrument. The percentage is based upon the total responses from the initial and follow-up responses.

Table 16 is a listing of the top thirteen subjects selected in descending order of importance for the initial responses. Note that twelve of the thirteen appeared in the follow-up, but the order of ranking changed slightly.

TABLE 16

COMPARISON OF THE TOP THIRTEEN SUBJECT AREAS FROM INITIAL RESPONSES

Subject Matter	Initial Rank	Follow-Up Rank
Electrical/Electronic Trouble-Shooting (Trb-Sht) . . .	1	2
Hydraulic Trb-Sht	2	1
Engine Trb-Sht	3	4
Engine, Diesel; Fuel Injection Systems Trb Sht	4	6
Hydraulics, Advanced (Study of Various Systems) . . .	5	5
Powershift & Automatic Transmissions Trb Sht	6	9
Safety	7	3
Engine, Diesel; Computer Controlled Fuel Systems	8	11
Electronic Controls (Process/Digital)	9	-
Air Brake & Anti-Skid Trb Sht . .	10	8
Welding	11	10
Computerized Parts, Service and Planned Maintenance Sys . .	12	12
Failure Analysis	13	7

When comparing the initial and follow-up responses, a positive correlation was found between business and industry for the percentage of "yes" responses for graduates, for the number of graduates needed, and in the rankings of the most important subject matter areas. Therefore, it is concluded that a majority of the non-respondents would have responded in a like manner making the responses received a representative sample of the heavy equipment industry.

RESEARCH QUESTION #1

Is there a need for a graduate with a Bachelor of Science Degree in Heavy Equipment Technology (HET)?

Question VIII of the survey instrument addressed this research question. The instructions were to circle either "yes" or "no". However, some responded with "?", and others failed to reply. Taking all of these responses into consideration, Table 17 shows the frequency of response and the percentage of the total for all of the responses.

TABLE 17

IS THERE A NEED FOR THE BS DEGREE GRADUATE?

Number and Percentage of Responders

Question	Yes	% Yes	No	% No	?	% ?	No Reply	% No Reply
Present Time	248	62.6	115	29.0	11	2.8	22	5.6
Five Years	325	82.1	18	4.5	28	7.1	25	6.3
Ten Years	302	76.3	10	2.5	41	10.4	43	10.9

Table 17 shows that there is a demand for the bachelor degree graduate. It also shows that there is a drastic drop in those indicating "no" as the time period increases.

RESEARCH QUESTION #2

How many Heavy Equipment Technology bachelor degree graduates are needed currently, in five years, and in ten years?

Tables 18, 19, and 20 depict the short and long term needs for the industry. Each table indicates how many graduates are needed, the frequency of the respondents selecting that number, total number of graduates needed, and the percentage of the total responding to that number. 396 respondents estimated that 2000 plus graduates are needed at the present time. The number will increase to over 5000 in five years, and to more than 14,000 in ten years.

TABLE 18

BS DEGREE GRADUATES NEEDED IMMEDIATELY

Number Needed	Frequency	Total Number	Percentage
No Response	67	0	16.9
0	93	0	23.5
1	103	103	26.0
2	57	114	14.4
3	20	60	5.1
4	14	56	3.5
5	19	95	4.8
6	1	6	0.3
8	2	16	0.5
9	1	9	0.3
10	11	110	2.8
11	1	11	0.3
15	1	15	0.3
35	1	35	0.3
37	1	37	0.3
50	2	100	0.5
300	1	300	0.3
1000	1	1000	0.3
	TOTAL	2067	

TABLE 19

BS DEGREE GRADUATES NEEDED OVER NEXT FIVE YEARS

Number Needed	Frequency	Total Number	Percentage
No Response	71	0	17.9
0	8	0	2.0
1	54	54	13.6
2	69	138	17.4
3	38	114	9.6
4	20	80	5.1
5	41	205	10.4
6	11	66	2.8
7	2	14	0.5
8	1	8	0.3
9	2	18	0.5
10	25	256	6.3
12	3	36	0.8
15	8	120	2.0
20	15	300	3.8
24	1	24	0.3
25	2	50	0.5
30	2	60	0.5
35	2	70	0.5
40	1	40	0.3
45	1	45	0.3
50	11	550	2.8
100	2	200	0.5
150	2	300	0.5
200	2	400	0.5
300	1	300	0.3
2000	1	2000	0.3
	TOTAL	5442	

TABLE 20

BS DEGREE GRADUATES NEEDED OVER NEXT TEN YEARS

Number Needed	Frequency	Total Number	Percentage
No Response	103	0	26.0
0	0	0	0.0
1	36	36	9.1
2	35	70	8.8
3	29	87	7.3
4	20	80	5.1
5	27	135	6.8
6	18	108	4.5
7	4	28	1.0
8	6	48	1.5
9	2	18	0.5
10	33	330	8.3
12	6	72	1.5
14	1	14	0.3
15	13	195	3.3
16	1	16	0.3
20	12	240	3.0
24	1	24	0.3
25	6	150	1.5
30	7	210	1.8
35	2	70	0.5
40	4	160	1.0
45	1	45	0.3
50	7	350	1.8
60	2	120	0.5
66	2	66	0.3
75	3	225	0.8
100	6	600	1.5
150	2	300	0.5
275	1	275	0.3
300	1	300	0.3
400	1	400	0.3
500	1	500	0.3
800	1	800	0.3
1000	1	1000	0.3
2000	1	2000	0.3
5000	1	5000	0.3
	TOTAL	14,072	

RESEARCH QUESTION #3

What subject matter areas are most important to the various industries within the Heavy Equipment Industry?

The most important subject matter areas were determined by the frequency that the respondents selected a particular subject matter area from the ten most important subjects listed in question number VII. Appendix VIII is a complete listing of all listed (83) subject matter areas and the frequency of responses for each. Table 21 illustrates the top five subject matter areas selected by the various industries.

Appendix IX is a complete listing of subject matter areas written in by respondents. Most of these responses were either very product specific or had a very low frequency of response.

TABLE 21

TOP FIVE SUBJECT MATTER AREAS BY INDUSTRY

Trucking	Frequency
Air Brake & Anti-Skid Trouble-Shooting (Trb-Sht)	57
Electrical/Electronics Trb-Sht	55
Safety	46
Engine Trb-Sht	44
Engine, Diesel; Fuel Inj. System Trb-Sht	42
Construction	
Hydraulics Trb-Sht	74
Electrical/Electronics Trb-Sht	74
Hydraulics, Advanced (Study of Various Systems)	60
Engine Trb-Sht	58
Failure Analysis	57
Agriculture	
Hydraulics Trb-Sht	52
Electrical/Electronics Trb-Sht	45
Engine Trb-Sht	42
Engine, Diesel; Fuel Inj. System Trb-Sht	40
Hydraulics, Advanced (Study of Various Systems)	39
Mining and Oil Field	
Hydraulics Trb-Sht	18
Safety	16
Electrical/Electronics Trb-Sht	12
Hydraulics, Advanced (Study of Various Systems)	11
Engine, Diesel; Fuel Inj. System Trb-Sht	9
Welding	9
Utilities	
Hydraulics Trb-Sht	9
Electrical/Electronics Trb-Sht	9
Engine, Diesel; Fuel Inj. System Trb-Sht	7
Failure Analysis	7
Air Brake & Anti-Skid Trb-Sht	7

TABLE 21 (continued)

Government/Military/Defense	Frequency
Electrical/Electronics Trb-Sht	16
Hydraulics Trb-Sht	15
Engine, Diesel; Fuel Inj. System Trb-Sht	15
Safety	11
Hydraulics, Advanced (Study of Various Systems)	11
Air Brake & Anti-Skid Trb-Sht	11
Computerized Parts, Service & Planned Main. Sys.	11
Marine/Refrigeration/Standby Power	
Electrical/Electronics Trb-Sht	13
Engine Trb-Sht	10
Generator Sets	10
Engine, Diesel Fuel Inj. System Trb-Sht	8
English Grammar	7
Material Handling	
Electrical/Electronics Trb-Sht	23
Hydraulics Trb-Sht	17
Engine Trb-Sht	17
Safety	17
Powershift & Automatic Trans. Trb-Sht	16
Forestry	
Hydraulic Trb-Sht	8
Failure Analysis	8
Engine Trb-Sht	6
Engine, Diesel; Fuel Inj. System Trb-Sht	6
Electrical/Electronics Trb-Sht	6
Hydraulics, Advanced (Study of Various Systems)	6
Air/Bus/Railroad Transportation	
Failure Analysis	7
Engine Trb-Sht	7
Electrical/Electronics Trb-Sht	6
Supervision and Leadership	5
Hydraulics Trb-Sht	4
Safety	4
Computerized Parts, Service & Planned Main. Sys.	4

TABLE 21 (continued)

Totals (Most Common)	Frequency
Electrical/Electronics Trb-Sht	261
Hydraulics Trb-Sht	216
Engine Trb-Sht	211
Safety	189
Failure Analysis	176

Electrical/Electronics troubleshooting was the most common subject matter area for all of the industries. Hydraulics troubleshooting was common to all areas except trucking, marine, refrigeration, and standby power. All of the industries indicated a need for a high concentration in troubleshooting courses.

RESEARCH QUESTION #4

How does the demand for subject matter listed in the HET technical areas compare to the demand for those listed as technical support and general education?

A complete listing of all subject matter areas is listed in Appendix X. In this appendix the total number of responses and the mean rating for each subject is listed. The respondents were instructed to circle the importance of each subject by rating it from one to four. If the subject was not applicable, it was to be left blank. To those that were left unanswered, the number of five was assigned for the study analysis. The rating scale is as follows:

Very Important	Important	Of Little Importance	Unimportant	Not Applicable
1	2	3	4	5

Therefore, those items with a mean of greater than 3.000 tend toward the unimportant and not applicable status. Those items less than 3.000 tend toward the important/very important status.

The subject matter areas were organized into six classifications on the survey instrument. Table 22 lists the six classifications and the overall average of the ratings in each classification.

TABLE 22

OVERALL AVERAGE RATING OF SUBJECT MATTER BY CLASSIFICATION

Subject Matter Area	Rating Average
Technical	2.655
English	2.670
Technical Support	3.093
Natural Science	3.505
Behavioral Science	3.545
Humanities	3.825

Table 23 identifies the top two subject matter areas for each classification.

TABLE 23

TOP TWO SUBJECT MATTER AREAS BY CLASSIFICATION

	Rating
Technical	
Safety	1.523
Electrical/Electronics Troubleshooting	1.578
English	
English Grammar	2.407
Technical & Occupational Writing	2.508
Technical Support	
Supervision & Leadership	2.093
Laws and Regulation, OSHA	2.515
Natural Sciences	
Fundamentals of Algebra	2.960
Intermediate Algebra	3.192
Behavioral Sciences	
Economics	3.164
Psychology	3.308
Humanities	
Humanities	3.558
Foreign Language	3.740

The technical classification rated the most important of all the categories. The fact that English was rated the second most important classification reflects industry's current need for better communication skills.

RESEARCH QUESTION #5

What are the most critical needs for updating and retraining the current heavy equipment industry workforce?

The most important subject matter areas for updating was determined by the frequency that the respondents selected a particular subject matter area in Question X on the survey instrument. Appendix XI is a complete listing of all the 83 subject matter areas and the frequencies of response for each.

Table 24 illustrates the top five subject matter areas for each industry. Appendix XI lists all the subject matter areas and the frequency of the responses for each industry.

TABLE 24

TOP FIVE RANKED SUBJECT MATTER AREAS FOR UPDATING BY INDUSTRY

Trucking	Frequency
Electrical/Electronic Trouble-shooting (Trb-Sht)	52
Engine, Diesel; Computer Controlled Fuel Systems	47
Air Brake & Anti-Skid Trb-Sht	37
Engine, Diesel; Fuel Injection System Trb-Sht	29
Engine Trb-Sht	23
Construction	
Electrical/Electronic Trb-Sht	69
Hydraulic Trb-Sht	47
Hydraulics, Advanced (Study of Various Systems)	39
Failure Analysis	28
Computerized Parts, Service & Planned Main. Sys.	25
Agriculture	
Electrical/Electronic Trb-Sht	36
Hydraulics Trb-Sht	27
Engine, Diesel; Fuel Injection System Trb-Sht	27
Hydraulics, Advanced (Study of Various Systems)	21
Powershift & Automatic Transmission Trb-Sht	20
Mining/Oil Fields	
Electrical/Electronic Trb-Sht	16
Hydraulics Trb-Sht	10
Electronic Controls (Process/Digital)	10
Hydraulics, Advanced (Study of Various Systems)	8
Engine Trb-Sht	6
Computerized Parts, Service & Planned Main. Sys.	6

TABLE 24 (continued)

Utilities	Frequency
Hydraulics, Advanced (Study of Various Systems)	8
Electrical/Electronic Trb-Sht	6
Engine, Diesel; Computer Controlled Fuel Systen	6
Engine, Diesel; Fuel Injection Sys. Trb-Sht	5
Engine Trb-Sht	5
Government/Military/Defense	
Electrical/Electronic Trb-Sht	14
Engine, Diesel; Computer Controlled Fuel Systems	12
Hydraulics, Advanced (Study of Various Systems)	9
Electronic Controls (Process/Digital)	8
Computerized Parts, Service & Planned Main. System	7
Marine/Refrigeration/Standby Power	
Fuels and Lubricants	10
Electrical/Electronic Trb-Sht	8
Engine Trb-Sht	5
Engine, Diesel; Computer Controlled Fuel Systems	4
Electronic Controls (Process/Digital)	3
Material Handling	
Electrical/Electronic Trb-Sht	17
Electronic Controls (Process/Digital)	8
Engine Trb-Sht	7
Powershift & Automatic Transmissions Trb-Sht	7
Computerized Parts, Service & Planned Main. System	6
Forestry	
Electrical/Electronic Trb-Sht	7
Hydraulic Trb-Sht	5
Failure Analysis	4
Hydraulics, Advanced (Study of Various Systems)	4
Engine, Diesel; Computer Controlled Fuel Systems	3

TABLE 24 (continued)

Air/Bus/Railroad Transportation	Frequency
Electrical/Electronics Trb-Sht	6
Engine Trb-Sht	5
Engine, Diesel; Computer Controlled Fuel Systems	4
Failure Analysis	4
Engine, Diesel; Fuel Injection System Trb-Sht	4

Totals	
Electrical/Electronic Trb-Sht	231
Engine, Diesel; Computer Controlled Fuel Systems	128
Hydraulics, Advanced (Study of Various Systems)	116
Electronic Controls (Process/Digital)	108
Hydraulics Trb-Sht	107

The most critical subject matter area was that of electrical/electronic troubleshooting. Troubleshooting courses in general were common in all industries.

RESEARCH QUESTION #6

What training sources will be used to update the current heavy equipment industry workforce?

Table 25 is a listing of the average percentage for each of the various types of training sources. This average was calculated for each individual category, therefore, the total adds up to more than 100%.

TABLE 25

ESTIMATED AVERAGE PERCENTAGE OF UPDATE TRAINING BY EACH SOURCE

Source	Average Percentage
In-House	46.3
Suppliers	19.2
Manufacturer	36.8
Educational Institutions	21.6
Educational Trg. Consultants	14.9
Other	24.7
Unknown	27.9

In-house training was the highest with 46.3% coming from that source. The role of Ferris State University in the updating process will most likely be that of addressing the needs of those 21.6% who indicated educational institutions and the 27.9% whose source was unknown.

SECTION 4

SUMMARY, FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

SUMMARY

This study was initiated to better define the role that the Heavy Equipment Technology Program at Ferris State University must assume in order to assist the heavy equipment industry in addressing the problems caused by expanding technology. The foundation of the study is the following research questions:

1. Is there a need for a graduate with a Bachelor of Science Degree in Heavy Equipment Technology (HET)?

2. How many HET Bachelor Degree graduates are needed currently, in five years, and in ten years?

3. What subject matter areas are most important to the various industries within the heavy equipment industry?

4. How does the demand for subject matter listed in the HET technical areas compare to the demand for those listed as technical support and general education?

5. What are the most critical needs for updating and retraining the current heavy equipment industry workforce?

6. What training sources will be used to update the current heavy equipment industry workforce?

Survey questionnaires were sent to 2396 potential respondents in the various industries that were selected from within the total heavy equipment industry. There were 396 responses received for an overall return rate of 16.9%. The study was conducted nationwide with the heaviest concentration of returns (55.3%) coming from the area of Michigan, Ohio, Indiana, Illinois, Wisconsin, and Ontario, Canada. Approximately two-thirds of the returns received were from the construction, trucking, and agricultural industries. Dealer/distributors, fleets, and manufacturers from all industries accounted for nearly 90% of the returns. The size of the businesses, determined by the number of employees, were quite evenly distributed over the entire size range. The heaviest concentration of 29.5% fell in the 11 to 49 employee range, however, 21.6% came from companies with 500 plus employees. The majority (78.6%) of the return population employs 50 or less service/maintenance technicians.

FINDINGS

1. Is there a need for a graduate with a Bachelor of Science Degree in Heavy Equipment Technology ?

Sixty-two percent (248) of the respondents indicated a need at the present time. Eighty-two percent (325) indicated a need in five years, and 76.3% (302) in ten years.

2. How many Heavy Equipment Technology Bachelor Degree graduates are needed currently, in five years, and in ten years?

The 396 respondents estimated a current need of 2000 plus graduates. That need will increase to over 5000 in five years and will exceed 14,000 in ten years.

3. What subject matter areas are important to the various industries within the heavy equipment industry?

Electrical/electronics trouble-shooting was common across all the heavy equipment industries. Hydraulic trouble-shooting was common to all industries except trucking, marine, refrigeration, and standby power. All industries indicated a need for a high concentration of trouble-shooting courses.

4. <u>How does the demand for subject matter listed in the HET technical areas compare to the demand for those listed as technical support and general education?</u>

The technical courses were rated most important in the ranking of all classifications. They were followed by English, technical support, natural sciences, behavioral sciences, and the humanities classifications respectively.

5. <u>What are the critical needs for updating and retraining the current heavy equipment industry workforce?</u>

The pattern was very similar to that of question number three. The most critical area is electrical/electronic trouble-shooting. All trouble-shooting courses were identified as being very important.

6. <u>What training sources will be used to update the current heavy equipment industry workforce?</u>

In-house training was the highest with 46.3%. Twenty-one percent indicated educational institutions, and nearly 28% did not know.

CONCLUSIONS

1. This study provides a solid base from which to plan and develop curriculum to better serve the needs of the heavy equipment industry.

2. It is concluded that the information gathered as a result of this study is a valid representative sample of the entire heavy equipment industry population.

3. It has been demonstrated through this survey, that a need exists for a bachelor of science degree in service technology within the heavy equipment industry.

4. The expanding technology in the heavy equipment industry is very technical in nature and demands good trouble-shooting skills for interfacing systems which require knowledge from a multiple of subject matter areas.

5. The subject matter areas needed to address expanding technology are very similar to the subject matter areas needed to update practicing heavy equipment mechanics and technicians.

6. The Heavy Equipment Technology Program at Ferris State University will serve a very important role in providing quality HET graduates, and in the updating and retraining

of current heavy equipment industry mechanics and technicians.

RECOMMENDATIONS

1. Ferris State University should implement a Bachelor of Science Degree in Service Technology in order to better serve the heavy equipment industry.

2. The first grouping of subject matter areas to be developed for the third and fourth year of a BS degree are:
    1. Trouble-shooting Strategies
    2. Electrical/Electronic Trouble-shooting
    3. Hydraulics Trouble-shooting
    4. Engine, Diesel: Computer Controlled Fuel Systems
    5. Engine Trouble-shooting
    6. Advanced Hydraulics

NOTE: The successful completion of the AAS Degree in Heavy Equipment Service Technology, or its equivalent, would be a prerequisite for entry into the BS Degree.

3. The development of the above courses and their prerequisites should be packaged so that they may be easily exported to the field for technical updating of practicing heavy equipment mechanics, technicians, and other service personnel.

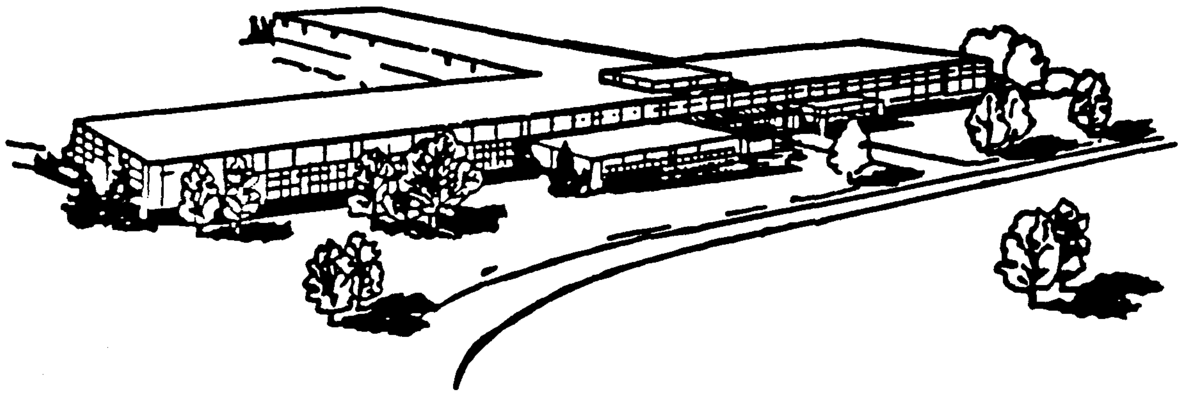
4. Ferris State University and the heavy equipment industry should continue to provide resources for the technical updating of faculty.

5. Ferris State University and the heavy equipment industry should provide resources to cooperatively develop a plan which would address the University's role in assisting the heavy equipment industry in updating the trainers who will provide the in-house training. The plan should also contain provisions for the updating and training needs of those industries who plan to use educational institutions, plus those whose source for updating and training is unknown.

6. Ferris State University and industry should provide the resources necessary to investigate and implement adequate methods of disseminating information to the industry for updating and retraining the current heavy equipment industry workforce.

APPENDICES

Ferris State University



Heavy Equipment Technology Center

School of Technology

The Heavy Equipment Technology Program at Ferris State University currently offers two year Associate of Applied Science Degrees in Heavy Equipment Service, and Heavy Duty Engine (Diesel/Electric) Technology. However, the proliferation of new technology, which is being incorporated into the design and manufacture of new heavy equipment, creates a dilemma which must be addressed. The dilemma, simply stated is: Obsolete skills and knowledge cannot be removed from courses at the same rate that new skills and knowledge must be added to meet the requirements of new and evolving technology.

In order to address this dilemma, consideration is being given to the implementation of a four-year Bachelor of Science Degree in Service Technology. Such a degree would provide the necessary time to incorporate additional courses that will address new technology.

The data collected from this instrument will be used to validate and modify existing courses, or implement new courses, if the need exists.

SURVEY
For Determining the Educational and Training Needs Of the Heavy Equipment Service Industry

I. WHAT IS YOUR PRESENT JOB TITLE? ______________________________

II. TO WHAT EXTENT IS YOUR COMPANY INVOLVED WITH THE FOLLOWING CLASSIFICATIONS WITHIN THE HEAVY EQUIPMENT INDUSTRY? Please indicate your percentage of involvement with each of the following business types:

a. Agriculture	______%
b. Air Transportation	______%
c. Bus Transportation	______%
d. Construction	______%
e. Forestry	______%
f. Government	______%
g. Marine	______%
h. Material Handling	______%
i. Military/Defense	______%
j. Mining	______%
k. Oil Field	______%
l. Railroad	______%
m. Refrigeration	______%
n. Standby Power	______%
o. Trucking	______%
p. Utilities	______%
TOTAL	100 %

III. WHAT IS THE TOTAL NUMBER OF EMPLOYEES AT YOUR FIRM? Circle the response below that indicates your firm's average number of employees:

a. Under 10	b. 11-49	c. 50-99
d. 100-249	e. 250-499	f. OVER 500

IV. HOW MANY OF THE EMPLOYEES IN YOUR FIRM ARE EMPLOYED AS MAINTENANCE OR SERVICE TECHNICIANS? ____________

V. WHICH OF THE FOLLOWING BEST DESCRIBES YOUR PARTICULAR BUSINESS OPERATIONS? (SELECT ONLY ONE)

___ Dealership/Distributor
___ Independent Repair Shop
___ Manufacturer
___ Major Component Rebuilder
___ Fleet
___ Rental/Leasing
___ Other: ______________________________

VI. PLEASE CIRCLE ONE OF THE NUMBERS IN THE RATING SCALE FOR EACH ITEM LISTED BELOW TO INDICATE THE IMPORTANCE OF THAT ITEM AS IT RELATES TO THE JOB PERFORMANCE OF YOUR SERVICE PERSONNEL. (Leave response blank if not applicable)

1 Very important
2 Important
3 Of little importance
4 Unimportant

TECHNICAL

1.	Air Brake & Anti-Skid Trouble Shooting	1	2	3	4
2.	Air Conditioning (Vehicle)	1	2	3	4
3.	Compressors (High Volume)	1	2	3	4
4.	Computerized Parts, Service and Planned Maintenance Systems	1	2	3	4
5.	Electrical/Electronic Trouble Shooting	1	2	3	4
6.	Electronic Controls (Process/Digital)	1	2	3	4
7.	Engine, Diesel; Computer Controlled Fuel Systems	1	2	3	4
8.	Engine, Diesel; Fuel Injection Systems Trouble Shooting	1	2	3	4
9.	Engine Trouble Shooting	1	2	3	4
10.	Failure Analysis	1	2	3	4
11.	Fleet Management	1	2	3	4
12.	Fuels and Lubricants	1	2	3	4
13.	Generator Sets	1	2	3	4
14.	Hydraulics, Advanced (Study of Various Systems)	1	2	3	4
15.	Hydraulic Trouble Shooting	1	2	3	4
16.	Internships	1	2	3	4
17.	Marine Applications	1	2	3	4
18.	Materials Used in the Industry (Characteristics & Properties Of)	1	2	3	4
19	Metallurgy	1	2	3	4
20.	Pneumatics	1	2	3	4
21.	Powershift & Automatic Transmissions Trouble Shooting	1	2	3	4
22.	Safety	1	2	3	4
23.	Steel Fabrication	1	2	3	4
24.	Suspension System Trouble Shooting	1	2	3	4
25.	Tires, Rims and Safety	1	2	3	4
26.	Tracks	1	2	3	4
27.	Trailers	1	2	3	4
28.	Transport Refrigeration	1	2	3	4
29.	Specifications, Vehicle (Ordering and Writing)	1	2	3	4
30.	Welding	1	2	3	4
31.	Other (specify) ________________	1	2	3	4
32.	Other (specify) ________________	1	2	3	4
33.	Other (specify) ________________	1	2	3	4
34.	Other (specify) ________________	1	2	3	4

TECHNICAL SUPPORT

35. Accounting, Dealership.......................... 1 2 3 4
36. Accounting, Financial........................... 1 2 3 4
37. Computer Aided Design, Beginning........... 1 2 3 4
38. Law, Business..................................... 1 2 3 4
39. Law, Labor... 1 2 3 4
40. Laws and Regulations, OSHA................. 1 2 3 4

41. Microcomputer Program Applications (General)................................ 1 2 3 4
42. Microcomputer Programming.................. 1 2 3 4
43. Risk Management................................. 1 2 3 4
44. Supervision and Leadership.................. 1 2 3 4
45. Other (specify) ______________________ 1 2 3 4
46. Other (specify) ______________________ 1 2 3 4
47. Other (specify) ______________________ 1 2 3 4

ENGLISH

48. English Grammar................................. 1 2 3 4
49. English Composition............................. 1 2 3 4
50. Technical and Occupational Writing......... 1 2 3 4
51. Advanced Technical Communication........... 1 2 3 4
52. Fundamentals of Public Speaking............ 1 2 3 4
53. Other (specify) ______________________ 1 2 3 4
54. Other (specify) ______________________ 1 2 3 4

HUMANITIES

55. Art.. 1 2 3 4
56. Drama.. 1 2 3 4
57. Foreign Language................................ 1 2 3 4
58. History.. 1 2 3 4
59. Humanities (learning concerned with man)... 1 2 3 4
60. Literature... 1 2 3 4
61. Music.. 1 2 3 4
62. Other (specify) ______________________ 1 2 3 4
63. Other (specify) ______________________ 1 2 3 4

BEHAVIORAL SCIENCE

64. Anthropology...................................... 1 2 3 4
65. Economics... 1 2 3 4
66. Political Science................................ 1 2 3 4
67. Psychology.. 1 2 3 4
68. Social Science.................................... 1 2 3 4
69. Sociology (study of human society).......... 1 2 3 4
70. Other (specify) ______________________ 1 2 3 4
71. Other (specify) ______________________ 1 2 3 4

NATURAL SCIENCES

72. Astronomy... 1 2 3 4
73. Fundamentals of Algebra...................... 1 2 3 4
74. Intermediate Algebra........................... 1 2 3 4
75. Biology.. 1 2 3 4
76. Chemistry.. 1 2 3 4
77. Geography... 1 2 3 4
78. Geology.. 1 2 3 4
79. Physical Science................................. 1 2 3 4
80. Physics.. 1 2 3 4
81. Trigonometry...................................... 1 2 3 4
82. Other (specify) ______________________ 1 2 3 4
83. Other (specify) ______________________ 1 2 3 4

VII. THE NEED EXISTS TO PRIORITIZE GENERAL EDUCATION, TECHNICAL, AND RELATED TECHNICAL SUBJECTS FOR INSTRUCTIONAL PURPOSES. PLEASE RANK ACCORDING TO IMPORTANCE, THE TEN MOST IMPORTANT SUBJECTS FROM QUESTIONS VI. PLACE THEIR LINE NUMBERS IN THE SPACES PROVIDED BELOW WITH 1 BEING MOST IMPORTANT, 2 SECOND MOST IMPORTANT, ETC. .

1. _____ 2. _____ 3. _____ 4. _____ 5. _____

6. _____ 7. _____ 8. _____ 9. _____ 10. _____

VIII. WOULD A GRADUATE WITH THE COURSE BACKGROUND OUTLINED ABOVE BE NEEDED IN YOUR BUSINESS?

(Please circle YES or NO for each line)

At The Present Time	YES	NO
In Five Years	YES	NO
In Ten Years	YES	NO

IX. IF YOU ANSWERED YES TO ANY OF THE ITEMS IN QUESTION VII, PLEASE HELP US PROJECT THE NEED FOR THESE GRADUATES IN YOUR INDUSTRY. Please estimate how many graduates your business could employ for the various time periods:

Number needed immediately ___
Number needed over next five years ___
Number needed over next ten years ___

X. PLEASE IDENTIFY THE FIVE MOST IMPORTANT SUBJECT AREAS, FROM QUESTION VI, IN WHICH YOUR CURRENT TECHNICIANS WILL NEED ADDITIONAL SKILLS AND KNOWLEDGE TO MEET PROJECTED JOB REQUIREMENTS WITHIN THE NEXT FIVE YEARS:

1. ____ 2. ____ 3. ____ 4. ____ 5. ____

XI. PLEASE INDICATE WHO WILL PROVIDE THE EDUCATION AND TRAINING REQUIRED TO UPGRADE YOUR TECHNICIANS:

In-house .... ____ %
Suppliers .... ____ %
Manufacturer.................... ____ %
Educational Institutions .... ____ %
Educational Training Consultants ____ %
Other (specify)________________ ____ %
Other (specify)________________ ____ %
Unknown .... ____ %

XII. ADDITIONAL SUGGESTIONS AND COMMENTS: Please use back of form or attach a separate sheet

Thank you again for your time and participation.

Ferris State University
Automotive & Heavy Equipment

April 11, 1990

Dear Industry Colleague:

The heavy equipment service industry is entering into a very critical decade. According to the Bureau of Labor Statistics, the industry will need an additional 100,000 technicians by the year 2000. It would appear this shortage, coupled with the demands of advancing technology, has the potential of increasing service problems within the industry.

The Heavy Equipment Program at Ferris State University is in the process of upgrading, modifying, and adding to its curriculum in order to address the employment and training needs of the future. This objective cannot be achieved without the support of representatives from the industries we serve.

We are soliciting your support by requesting that you fill out the attached survey and return it by April 20, 1990. A self addressed, postage paid envelope is enclosed for your convenience.

Your assistance in helping us solve a problem, whose solution will be mutually beneficial to employers, practicing mechanics and technicians, students, graduates, and the Heavy Equipment Program at Ferris State University, is greatly appreciated.

Sincerely,

J. Maurice Ansolabehere

J. Maurice Ansolabehere, Head
Automotive and Heavy Equipment
Department

Enclosure

School of Technology • Big Rapids, Michigan 49307 • (616) 592-2810

Attn. Heavy Equipment Center

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School of Technology 4-15145
901 South State Street
Big Rapids, Michigan 49307-9963

Ferris State University
Automotive & Heavy Equipment

April 26, 1990

Dear Industry Colleague:

The heavy equipment industry is entering into a very critical decade. According to Bureau of Labor statistics, the industry will need an additional 100,000 technicians by the year 2000. This shortage, coupled with the demands of advancing technology, will increase problems associated with the delivery of education and training to support quality service. Ferris State University is upgrading its Heavy Equipment Technology curriculum to help keep these problems to a minimum. We must have recommendations and suggestions from the industries we serve in order to address the employment requirements of those industries.

In early April you were sent a survey instrument which would help us in our decision making process. As of this date, we have not received your reply to the survey. Your input is vital in our decision making process! Would you please complete the enclosed survey and return as soon as possible? An immediate response is needed, and would be greatly appreciated.

Sincerely yours,

Joel D. Galloway, Dean
School of Technology

Enclosure

School of Technology • Big Rapids, Michigan 49307 • (616) 592-2810

APPENDIX V

COMPARISON OF INITIAL AND FOLLOW-UP SURVEYS

NEED FOR BS DEGREE GRADUATES

NUMBER OF RESPONDERS

Would a graduate with the course background outlined above be needed in your business?

	Initial				Follow-up			
	Yes	No	?	No Ans	Yes	No	?	No Ans
Present Time	178	67	10	15	55	35	0	5
Five Years	225	9	19	17	79	6	5	5
Ten Years	207	5	27	31	75	3	9	8

PERCENTAGE OF RESPONDERS

Would a graduate with the course background outlined above be needed in your business?

	Initial				Follow-up			
	Yes	No	?	No Ans	Yes	No	?	No Ans
Present Time	65.9	24.8	3.7	5.6	57.9	36.8	0	5.3
Five Years	83.3	3.3	7.0	6.3	83.2	6.3	5.3	5.3
Ten Years	76.7	1.9	10.0	11.5	78.9	3.2	9.5	8.4

APPENDIX VI

INITIAL AND FOLLOW-UP COMPARISON

NUMBER OF BS GRADUATES NEEDED IMMEDIATELY

	Initial		Follow-up	
Number Needed	Frequency	%	Frequency	%
No Response	42	15.6	17	17.9
0	59	21.9	26	27.4
1	66	24.4	30	31.6
2	44	16.3	10	10.5
3	16	5.9	3	3.2
4	9	3.3	2	2.1
5	16	5.9	2	2.1
6	1	0.4		
8	2	0.7		
9			1	1.1
10	10	3.7	1	1.1
11	1	.4		
15	1	.4		
35	1	.4		
37	1	.4		
50	1	.4	1	1.1
300			1	1.1
1000			1	1.1

APPENDIX VI CONTINUED

INITIAL AND FOLLOW-UP COMPARISON

NUMBER OF BS GRADUATES NEEDED IN FIVE YEARS

	Initial		Follow-up	
Number Needed	Frequency	%	Frequency	%
No Response	46	17.0	17	17.9
0	5	1.9	2	2.1
1	36	13.3	15	15.8
2	43	15.9	21	22.1
3	24	8.9	11	11.6
4	16	5.9	3	3.2
5	26	9.6	13	13.7
6	10	3.7	1	1.1
7	2	0.7		
8	1	0.4		
9	1	0.4		
10	22	8.1	2	2.1
12	1	0.4	1	1.1
15	6	2.2	2	2.1
20	12	4.4	1	1.1
24	1	0.4		
25	2	0.7		
30	1	0.4	1	1.1
35	1	0.4	1	1.1
40	1	0.4		
45			1	1.1
50	9	3.3		
100	2	0.7		
150	1	0.4		
200	1	0.4	1	1.1
300			1	1.1
2000			1	1.1

APPENDIX VI CONTINUED

INITIAL AND FOLLOW-UP COMPARISON

NUMBER OF BS GRADUATES NEEDED IN TEN YEARS

Number Needed	Initial Frequency	Initial %	Follow-up Frequency	Follow-up %
No Response	68	25.2	27	24.2
1	22	8.1	11	11.6
2	22	8.1	11	11.6
3	19	7.0	8	8.4
4	12	4.4	7	7.4
5	16	5.9	10	10.5
6	13	4.8	4	4.2
7	3	1.1	1	1.1
8	3	1.1	2	2.1
9	2	0.7		
10	26	9.6	6	6.3
12	5	1.9	1	1.1
15	11	4.1	2	2.1
16	1	0.4		
20	12	4.4		
25	5	1.9		
30	5	1.9	1	1.1
35			1	1.1
40	3	1.1	1	1.1
45			1	1.1
50	4	1.5	1	1.1
60	2	0.7		
66	1	0.4		
75	2	0.7	1	1.1
100	6	2.2		
150	2	0.7		
275	1	0.4		
300	1	0.4		
400	1	0.4		
500	1	0.4		
800	1	0.4		
1000			1	1.1
2000			1	1.1
5000			1	1.1

APPENDIX VII

RANKED COMPARISON BETWEEN INITIAL AND FOLLOW-UP SURVEYS

FREQUENCY LISTED AS ONE OF TEN MOST IMPORTANT SUBJECTS

	Initial Responses		Follow-up Responses	
	#	%	#	%
TECHNICAL				
1. Air Brake & Anti-Skid Trb-Sht	66	24.4	28	29.5
2. Air Conditioning (Vehicle) . .	42	15.6	17	17.9
3. Compressors (High Volume) . .	19	7.0	3	3.2
4. Computerized Parts, Service and Planned Maintenance Sys	61	22.6	22	23.2
5. Electrical/Electronic Trb-Sht	191	70.7	50	52.6
6. Electronic Controls (Process/Digital)	78	28.9	9	9.5
7. Engine, Diesel; Computer Controlled Fuel Systems . .	88	32.6	25	26.3
8. Engine, Diesel; Fuel Injection Systems Trb-Sht	132	48.9	41	43.2
9. Engine Trb-Sht	150	55.6	45	47.4
10. Failure Analysis	59	28.9	31	32.7
11. Fleet Management	29	10.7	14	14.7
12. Fuels and Lubricants	31	11.5	15	15.8
13. Generator Sets	30	11.1	3	3.2
14. Hydraulics, Advanced (Study of Various Systems) .	111	41.1	43	45.3
15. Hydraulic Trb-Sht	153	56.7	52	54.8
16. Internships	9	3.3	3	3.2
17. Marine Applications	12	4.4	1	1.1
18. Materials Used in the Industry (Characteristics/Properties Of)	5	1.9	5	5.3
19 Metallurgy	10	3.7	7	7.4
20. Pneumatics	18	6.7	8	8.4
21. Powershift & Automatic Transmissions Trb-Sht . . .	93	34.4	26	27.4
22. Safety	93	34.4	46	48.4
23. Steel Fabrication	29	10.7	12	12.6
24. Suspension System Trb-Sht . .	29	10.7	11	11.6
25. Tires, Rims and Safety	24	8.9	14	14.8
26. Tracks	21	7.8	4	4.2
27. Trailers	21	7.8	9	9.5
28. Transport Refrigeration . . .	7	2.6	3	3.6
29. Specifications, Vehicle (Ordering and Writing) . . .	13	4.8	8	8.4
30. Welding	61	22.6	26	27.7
31. Other (specify) ________	4	1.5	1	1.1
32. Other (specify) ________	4	1.5	0	0
33. Other (specify) ________	1	0.4	0	0
34. Other (specify) ________	2	0.7	0	0

	Initial Responses #	Initial Responses %	Follow-up Responses #	Follow-up Responses %
TECHNICAL SUPPORT				
35. Accounting, Dealership	17	6.3	8	8.4
36. Accounting, Financial	15	5.6	5	5.3
37. Computer Aided Design, Begin .	12	4.4	6	6.3
38. Law, Business	4	1.4	3	3.2
39. Law, Labor	8	3.0	1	1.1
40. Laws and Regulations, OSHA . .	38	14.1	13	13.7
41. Microcomputer Program Applications (General) . . .	17	6.3	6	6.3
42. Microcomputer Programming . .	3	1.1	1	1.1
43. Risk Management	6	2.2	2	2.1
44. Supervision and Leadership . .	63	23.3	27	28.4
45. Other (specify) ____________	2	0.7	0	0
46. Other (specify) ____________	1	0.3	0	0
47. Other (specify) ____________	1	0.3	0	0
ENGLISH				
48. English Grammar	52	19.3	18	18.9
49. English Composition	35	13.0	14	14.7
50. Technical and Occupational Writing	43	15.9	20	21.1
51. Advanced Technical Communication	22	8.1	10	10.5
52. Fundamentals of Public Speaking	20	7.4	8	8.4
53. Other (specify) ____________	1	0.3	0	0
54. Other (specify) ____________	0	0	0	0
HUMANITIES				
55. Art	0	0	0	0
56. Drama	1	0.3	0	0
57. Foreign Language	1	0.3	1	1.1
58. History	2	0.7	0	0
59. Humanities	5	1.9	0	0
60. Literature	1	0.3	0	0
61. Music	0	0	0	0
62. Other (specify) ____________	1	0.3	0	0
63. Other (specify) ____________	0	0	0	0

APPENDIX VII CONTINUED

	Initial Responses #	Initial Responses %	Follow-up Responses #	Follow-up Responses %
BEHAVIORAL SCIENCE				
64. Anthropology	0	0	1	1.1
65. Economics	10	3.7	5	5.3
66. Political Science	3	1.1	0	0
67. Psychology	12	4.4	4	4.2
68. Social Science	3	1.1	1	1.1
69. Sociology	8	3.0	2	2.1
70. Other (specify) ________	2	0.7	0	0
71. Other (specify) ________	1	0.3	0	0
NATURAL SCIENCES				
72. Astronomy	2	0.7	0	0
73. Fundamentals of Algebra . . .	20	7.4	10	10.3
74. Intermediate Algebra	10	3.7	4	4.2
75. Biology	1	0.3	0	0
76. Chemistry	4	1.5	5	5.7
77. Geography	4	1.5	1	1.1
78. Geology	3	1.1	3	3.2
79. Physical Science	15	5.6	5	5.3
80. Physics	19	7.0	10	10.5
81. Trigonometry	6	2.2	5	5.3
82. Other (specify) ________	0	0	0	0
83. Other (specify) ________	0	0	0	0

APPENDIX VIII

RANKED SUBJECT MATTER AREA RESPONSES BY INDUSTRY

O Trucking
D Construction
A Agriculture

TECHNICAL	O	D	A
1. Air Brake & Anti-Skid Trb-Sht	57	12	6
2. Air Conditioning (Vehicle) . .	22	6	28
3. Compressors (High Volume) . .	6	11	2
4. Computerized Parts, Service and Planned Maintenance Sys	15	20	16
5. Electrical/Electronic Trb-Sht	55	74	45
6. Electronic Controls (Process/Digital)	21	23	18
7. Engine, Diesel; Computer Controlled Fuel Systems . .	35	24	22
8. Engine, Diesel; Fuel Injection Systems Trb-Sht	42	45	40
9. Engine Trb-Sht	44	58	42
10. Failure Analysis	40	57	28
11. Fleet Management	13	14	1
12. Fuels and Lubricants	10	16	10
13. Generator Sets	1	9	3
14. Hydraulics, Advanced (Study of Various Systems) .	10	60	39
15. Hydraulic Trb-Sht	16	74	52
16. Internships	3	4	4
17. Marine Applications	1	3	
18. Materials Used in the Industry (Characteristics/Properties Of)	4	2	2
19 Metallurgy	3	8	2
20. Pneumatics	7	10	2
21. Powershift & Automatic Transmissions Trb-Sht . . .	11	37	33
22. Safety	46	48	28
23. Steel Fabrication	11	13	3
24. Suspension System Trb-Sht . .	34	4	
25. Tires, Rims and Safety	15	6	
26. Tracks	4	13	2
27. Trailers	28	2	
28. Transport Refrigeration . . .	8		1
29. Specifications, Vehicle (Ordering and Writing) . . .	8	5	1
30. Welding	25	33	10

31. Other (specify) ______________
32. Other (specify) ______________
33. Other (specify) ______________
34. Other (specify) ______________

APPENDIX VIII CONTINUED

RANKED SUBJECT MATTER AREA RESPONSES BY INDUSTRY

O Trucking
D Construction
A Agriculture

TECHNICAL SUPPORT	O	D	A
35. Accounting, Dealership	5	9	8
36. Accounting, Financial	3	5	6
37. Computer Aided Design, Begin .		9	6
38. Law, Business		1	3
39. Law, Labor	4		2
40. Laws and Regulations, OSHA . .	12	17	10
41. Microcomputer Program Applications (General) . . .	1	11	4
42. Microcomputer Programming . .	2	1	
43. Risk Management	3	3	1
44. Supervision and Leadership . .	16	41	15
45. Other (specify) ______________			
46. Other (specify) ______________			
47. Other (specify) ______________			
ENGLISH			
48. English Grammar	16	26	9
49. English Composition	8	20	5
50. Technical and Occupational Writing	13	29	10
51. Advanced Technical Communication	2	17	5
52. Fundamentals of Public Speaking	4	12	4
53. Other (specify) ______________			
54. Other (specify) ______________			
HUMANITIES			
55. Art			
56. Drama		1	
57. Foreign Language	1	1	
58. History		2	
59. Humanities	2		1
60. Literature		1	
61. Music			
62. Other (specify) ______________			
63. Other (specify) ______________			

APPENDIX VIII CONTINUED

RANKED SUBJECT MATTER AREA RESPONSES BY INDUSTRY

O Trucking
D Construction
A Agriculture

BEHAVIORAL SCIENCE	O	D	A
64. Anthropology	1		
65. Economics	2	6	4
66. Political Science	1	1	
67. Psychology	1	6	3
68. Social Science		2	1
69. Sociology	2	4	2
70. Other (specify) ______________			
71. Other (specify) ______________			

NATURAL SCIENCES	O	D	A
72. Astronomy			
73. Fundamentals of Algebra . . .	6	6	3
74. Intermediate Algebra	2	5	3
75. Biology			
76. Chemistry	2	4	1
77. Geography	1	1	1
78. Geology	2	2	
79. Physical Science	4	6	1
80. Physics	5	15	2
81. Trigonometry		5	
82. Other (specify) ______________			
83. Other (specify) ______________			

Heavy Equipment Technology/
Heavy Equipment Service Engineering
Technology

APRC 1998-1999

Section 8 of 8

APPENDIX VIII CONTINUED

RANKED SUBJECT MATTER AREA RESPONSES BY INDUSTRY

J Mining
K Oil Field
P Utilities
G Government
H Military/Defense

TECHNICAL	JK	P	GH
1. Air Brake & Anti-Skid Trb-Sht	5	7	11
2. Air Conditioning (Vehicle) . .	1		4
3. Compressors (High Volume) . .	2		
4. Computerized Parts, Service and Planned Maintenance Sys	5	6	11
5. Electrical/Electronic Trb-Sht	12	9	16
6. Electronic Controls (Process/Digital)	7	4	5
7. Engine, Diesel; Computer Controlled Fuel Systems . .	6	4	10
8. Engine, Diesel; Fuel Injection Systems Trb-Sht	9	7	15
9. Engine Trb-Sht	8	7	9
10. Failure Analysis	5	4	6
11. Fleet Management	3	2	10
12. Fuels and Lubricants	6		3
13. Generator Sets	2	2	1
14. Hydraulics, Advanced (Study of Various Systems)	11	6	11
15. Hydraulic Trouble-shooting . .	18	9	15
16. Internships			
17. Marine Applications	1	1	1
18. Materials Used in the Industry (Characteristics/Properties Of)	1		1
19 Metallurgy	1		
20. Pneumatics	3	1	4
21. Powershift & Automatic Transmissions Trb-Sht . . .	8	3	6
22. Safety	16	6	11
23. Steel Fabrication	5		4
24. Suspension System Trb-Sht . .	2	2	2
25. Tires, Rims and Safety	7	3	3
26. Tracks	2		
27. Trailers	1		
28. Transport Refrigeration . . .			
29. Specifications, Vehicle (Ordering and Writing) . . .	1	1	8
30. Welding	9	1	5
31. Other (specify) ____________			
32. Other (specify) ____________			
33. Other (specify) ____________			
34. Other (specify) ____________			

APPENDIX VIII CONTINUED

RANKED SUBJECT MATTER AREA RESPONSES BY INDUSTRY

J Mining
K Oil Field
P Utilities
G Government
H Military/Defense

TECHNICAL SUPPORT	JK	P	GH
35. Accounting, Dealership			
36. Accounting, Financial			5
37. Computer Aided Design, Begin			1
38. Law, Business	1		
39. Law, Labor	1		1
40. Laws and Regulations, OSHA		2	4
41. Microcomputer Program Applications (General)	2		2
42. Microcomputer Programming			
43. Risk Management			
44. Supervision and Leadership	4	1	8
45. Other (specify) ______			
46. Other (specify) ______			
47. Other (specify) ______			
ENGLISH			
48. English Grammar	6	4	4
49. English Composition	2	3	3
50. Technical and Occupational Writing	4	1	7
51. Advanced Technical Communication	2		3
52. Fundamentals of Public Speaking	3	1	1
53. Other (specify) ______			
54. Other (specify) ______			
HUMANITIES			
55. Art			
56. Drama			
57. Foreign Language			
58. History			
59. Humanities		1	
60. Literature			
61. Music			
62. Other (specify) ______			
63. Other (specify) ______			

APPENDIX VIII CONTINUED

RANKED SUBJECT MATTER AREA RESPONSES BY INDUSTRY

J Mining
K Oil Field
P Utilities
G Government
H Military/Defense

BEHAVIORAL SCIENCE	JK	P	GH
64. Anthropology			
65. Economics	1	1	1
66. Political Science	1		
67. Psychology	1		
68. Social Science			
69. Sociology			2
70. Other (specify) ______________			
71. Other (specify) ______________			
NATURAL SCIENCES			
72. Astronomy			1
73. Fundamentals of Algebra . . .	4	1	2
74. Intermediate Algebra	1		
75. Biology			
76. Chemistry	1		
77. Geography			1
78. Geology	1		
79. Physical Science	2	1	1
80. Physics	1	1	
81. Trigonometry	2		
82. Other (specify) ______________			
83. Other (specify) ______________			

APPENDIX VIII CONTINUED

RANKED SUBJECT MATTER AREA RESPONSES BY INDUSTRY

G Marine
M Refrigeration
N Standby Power
H Material Handling
E Forestry

TECHNICAL	GMN	H	E
1. Air Brake & Anti-Skid Trb-Sht	2	1	3
2. Air Conditioning (Vehicle) . .	1	1	2
3. Compressors (High Volume) . .	2	1	
4. Computerized Parts, Service and Planned Maintenance Sys	4	6	
5. Electrical/Electronic Trb-Sht	13	23	6
6. Electronic Controls (Process/Digital)	4	8	3
7. Engine, Diesel; Computer Controlled Fuel Systems . .	6	3	3
8. Engine, Diesel; Fuel Injection Systems Trb-Sht	8	7	6
9. Engine Trb-Sht	10	17	6
10. Failure Analysis	6	12	8
11. Fleet Management	3	3	
12. Fuels and Lubricants	2	2	1
13. Generator Sets	10	1	1
14. Hydraulics, Advanced (Study of Various Systems)	1	14	6
15. Hydraulic Trb-Sht	1	17	8
16. Internships	1		
17. Marine Applications	5		1
18. Materials Used in the Industry Characteristics/Properties Of)			1
19. Metallurgy		1	1
20. Pneumatics	1	1	
21. Powershift & Automatic Transmissions Trb-Sht . . .	2	16	3
22. Safety	6	17	5
23. Steel Fabrication	2	4	2
24. Suspension System Trb-Sht . .			
35. Tires, Rims and Safety	1	3	1
26. Tracks		2	1
27. Trailers	1	1	
28. Transport Refrigeration	2		
29. Specifications, Vehicle (Ordering and Writing) . . .		2	
30. Welding	2	9	2

31. Other (specify) ____________
32. Other (specify) ____________
33. Other (specify) ____________
34. Other (specify) ____________

APPENDIX VIII CONTINUED

RANKED SUBJECT MATTER AREA RESPONSES BY INDUSTRY

G Marine
M Refrigeration
N Standby Power
H Material Handling
E Forestry

TECHNICAL SUPPORT	GMN	H	E
35. Accounting, Dealership	1	2	
36. Accounting, Financial	1	1	1
37. Computer Aided Design, Begin .	1	2	
38. Law, Business		1	1
39. Law, Labor			
40. Laws and Regulations, OSHA . .	2	6	1
41. Microcomputer Program Applications (General) . . .		2	
42. Microcomputer Programming . .			
43. Risk Management		2	
44. Supervision and Leadership . .	2	8	2
45. Other (specify) ______________			
46. Other (specify) ______________			
47. Other (specify) ______________			

ENGLISH	GMN	H	E
48. English Grammar	7	4	2
49. English Composition	3	5	2
50. Technical and Occupational Writing	3	5	2
51. Advanced Technical Communication		3	1
52. Fundamentals of Public Speaking		3	1
53. Other (specify) ______________			
54. Other (specify) ______________			

HUMANITIES	GMN	H	E
55. Art			
56. Drama			
57. Foreign Language			1
58. History			
59. Humanities			
60. Literature			
61. Music			
62. Other (specify) ______________			
63. Other (specify) ______________			

APPENDIX VIII CONTINUED

RANKED SUBJECT MATTER AREA RESPONSES BY INDUSTRY

G Marine
M Refrigeration
N Standby Power
H Material Handling
E Forestry

BEHAVIORAL SCIENCE	GMN	H	E
64. Anthropology			
65. Economics	2	1	
66. Political Science			
67. Psychology	2	2	
68. Social Science			
69. Sociology			2
70. Other (specify) ______			
71. Other (specify) ______			
NATURAL SCIENCES			
72. Astronomy	1		1
73. Fundamentals of Algebra	4	4	2
74. Intermediate Algebra	1		1
75. Biology			1
76. Chemistry			
77. Geography			1
78. Geology			1
79. Physical Science		2	1
80. Physics		2	2
81. Trigonometry	1	2	
82. Other (specify) ______			
83. Other (specify) ______			

RANKED SUBJECT MATTER AREA RESPONSES BY INDUSTRY

B Air Transportation
C Bus Transportation
L Railroad

TECHNICAL	BCL	Totals
1. Air Brake & Anti-Skid Trb-Sht		105
2. Air Conditioning (Vehicle) . .	1	66
3. Compressors (High Volume) . .		24
4. Computerized Parts, Service and Planned Maintenance Sys	4	91
5. Electrical/Electronic Trb-Sht	6	261
6. Electronic Controls (Process/Digital)	2	96
7. Engine, Diesel; Computer Controlled Fuel Systems . .	3	122
8. Engine, Diesel; Fuel Injection Systems Trb-Sht	4	186
9. Engine Trb-Sht	7	211
10. Failure Analysis	7	176
11. Fleet Management		49
12. Fuels and Lubricants		52
13. Generator Sets	3	34
14. Hydraulics, Advanced (Study of Various Systems)	2	163
15. Hydraulic Trb-Sht	4	216
16. Internships	1	13
17. Marine Applications	2	15
18. Materials Used in the Industry (Characteristics/Properties Of)		11
19 Metallurgy		17
20. Pneumatics	1	31
21. Powershift & Automatic Transmissions Trb-Sht . . .	3	124
22. Safety	4	189
23. Steel Fabrication		44
24. Suspension System Trb-Sht . .		44
25. Tires, Rims and Safety		41
26. Tracks	1	25
27. Trailers		33
28. Transport Refrigeration . . .		11
29. Specifications, Vehicle (Ordering and Writing) . . .		26
30. Welding		97
31. Other (specify) ____________		
32. Other (specify) ____________		

APPENDIX VIII CONTINUED

RANKED SUBJECT MATTER AREA RESPONSES BY INDUSTRY

B Air Transportation
C Bus Transportation
L Railroad

TECHNICAL SUPPORT	BCL	Totals
35. Accounting, Dealership	1	26
36. Accounting, Financial	1	23
37. Computer Aided Design, Begin .		19
38. Law, Business		7
39. Law, Labor	2	10
40. Laws and Regulations, OSHA . .	2	56
41. Microcomputer Program Applications (General) . . .	2	24
42. Microcomputer Programming . .	1	4
43. Risk Management	1	10
44. Supervision and Leadership . .	5	102
45. Other (specify) ______________		
46. Other (specify) ______________		
47. Other (specify) ______________		
ENGLISH		
48. English Grammar	3	81
49. English Composition	3	54
50. Technical and Occupational Writing	4	78
51. Advanced Technical Communication	1	34
52. Fundamentals of Public Speaking	1	33
53. Other (specify) ______________		
54. Other (specify) ______________		
HUMANITIES		
55. Art		
56. Drama		1
57. Foreign Language		3
58. History		2
59. Humanities		5
60. Literature		1
61. Music		
62. Other (specify) ______________		
63. Other (specify) ______________		

APPENDIX VIII CONTINUED

RANKED SUBJECT MATTER AREA RESPONSES BY INDUSTRY

B Air Transportation
C Bus Transportation
L Railroad

BEHAVIORAL SCIENCE	BCL	Totals
64. Anthropology		1
65. Economics		18
66. Political Science		3
67. Psychology	1	16
68. Social Science	1	4
69. Sociology		12
70. Other (specify) ____________		
71. Other (specify) ____________		

NATURAL SCIENCES	BCL	Totals
72. Astronomy		3
73. Fundamentals of Algebra . . .	2	34
74. Intermediate Algebra	2	15
75. Biology		
76. Chemistry		9
77. Geography		5
78. Geology		6
79. Physical Science	2	20
80. Physics	2	30
81. Trigonometry	1	11
82. Other (specify) ____________		
83. Other (specify) ____________		

APPENDIX IX

ADDITIONAL SUBJECT MATTER AREAS LISTED BY RESPONDENTS

TECHNICAL

SCR Controls
Farm Machinery Trouble-Shooting
Drive Lines
Gaseous Fuel Systems
Transfer Switches
Governors & Controls
Common Sense
Good Attitude
Hard Worker
Ag Equipment; Combine, Plow, Planter, etc.;
Transistor Controls
Steering System
Door Controls
Creative Thinking in Service
Hydraulic/Electric Control Systems
Turbines
Programmable Logic Controllers
Project Management
Front End & Alignment
Driveability Trouble-Shooting
Blue Print Reading
Rock Drilling
Drill Bits & Steel for Rock Drilling
Oil Analysis
Lift Gates
Cost Control
People Development
Quality
Powertrains, Transmissions, & Differentials
Railroad Suspension Systems
Railroad Wheels
Small Two-Cycle Gas Engines
Railroad Specialized Equipment
Agricultural Transmissions
Small Engine Service
Perform Planned Maintenance
Diagnose Failure and Repair
Combustion Engineering
Cooling Process Design
Heat Recovery Design
Electrical Systems
Cooling Systems
Component Rebuild
Repairing, Mechanical, Improvising
Parts Replacer

APPENDIX IX CONTINUED

ADDITIONAL SUBJECT MATTER AREAS LISTED BY RESPONDENTS

TECHNICAL (CONTINUED)

Effects of Radio Transmission
Electronic Control System
Basic Electricity
Computer Controlled Hydraulics
Computer Controlled Transmissions
Parts Ordering
Work Order Reports
Inspection Reports
Equipment Operating Requirements
Electricity/Electronics
DC Electric Motors
Planned Maintenance
Gearing
Hydraulic Brakes
Body Repair
Fiberglass Repair
Basic Machine Shop Procedure
Engine Rebuild
Ultrasound & Vibration Analysis
N.D.T.
Sales; Inside & Outside
Gas Engines & Carburetors
Electrical Rotating Equipment
High Voltage/High Power Safety
High Voltage/High Power Trouble-Shooting
FWHA Trailer Inspection
Hydraulic Brake Systems
How to Discuss Failure Details with Customers
Read Electronic Schematics

APPENDIX IX CONTINUED

ADDITIONAL SUBJECT MATTER AREAS LISTED BY RESPONDENTS

TECHNICAL SUPPORT

Service Merchandising
Management
Marketing & Customer Relations
Salesmanship
Shop Layout & Special Tooling
Isometric Drafting
Warranties
Customer Relations
DOT Maintenance & Service
Publications, Parts & Service
Planned Maintenance Services for Equipment
Organizational Behavior
US/Japanese Communications
Report Writing
Interpersonal Skills
Video Training
Quantitative & Qualitative Testing
Budgets, Forecasts, Capitalized Expenditures
Penmanship
Customer Communication
Typing

OTHER

Shop Mathematics
Math
Technical Writing
Presentation Skills
Reading Technical Manuals
Letter Writing
Buying & Selling
Geometry
Reading
Spelling
General Math

APPENDIX X

RATED SUBJECT MATTER AREA

TECHNICAL	Total Number of Responses	Rating
1. Air Brake & Anti-Skid Trb-Sht	326	2.833
2. Air Conditioning (Vehicle)	339	2.939
3. Compressors (High Volume)	313	3.207
4. Computerized Parts, Service and Planned Maintenance Sys	350	2.346
5. Electrical/Electronic Trb-Sht	376	1.578
6. Electronic Controls (Process/Digital)	345	2.379
7. Engine, Diesel; Computer Controlled Fuel Systems	357	2.131
8. Engine, Diesel; Fuel Injection Systems Trb-Sht	372	1.760
9. Engine Trb-Sht	373	1.657
10. Failure Analysis	366	1.881
11. Fleet Management	335	2.960
12. Fuels and Lubricants	358	2.444
13. Generator Sets	332	3.040
14. Hydraulics, Advanced (Study of Various Systems)	361	1.997
15. Hydraulic Trb-Sht	362	1.904
16. Internships	310	3.348
17. Marine Applications	284	3.929
18. Materials Used in the Industry (Characteristics/Properties Of)	308	3.356
19 Metallurgy	308	3.386
20. Pneumatics	317	3.008
21. Powershift & Automatic Transmissions Trb-Sht	348	2.308
22. Safety	374	1.523
23. Steel Fabrication	337	2.836
24. Suspension System Trb-Sht	330	2.876
25. Tires, Rims and Safety	338	2.596
26. Tracks	314	3.225
27. Trailers	326	3.048
28. Transport Refrigeration	290	3.881
29. Specifications, Vehicle (Ordering and Writing)	311	3.109
30. Welding	358	2.169
31. Other (specify) ______		
32. Other (specify) ______	Average	2.655
33. Other (specify) ______		
34. Other (specify) ______		

APPENDIX X CONTINUED

RATED SUBJECT MATTER AREAS

TECHNICAL SUPPORT	Total Number of Responses	Rating
35. Accounting, Dealership	314	3.187
36. Accounting, Financial	325	3.038
37. Computer Aided Design, Beginning . .	302	3.437
38. Law, Business	313	3.419
39. Law, Labor	316	3.311
40. Laws and Regulations, OSHA	341	2.515
41. Microcomputer Program Applications (General)	310	3.220
42. Microcomputer Programming	298	3.515
43. Risk Management	307	3.278
44. Supervision and Leadership	353	2.093
45. Other (specify) ________________		
46. Other (specify) ________________	Average	3.093
47. Other (specify) ________________		
ENGLISH		
48. English Grammar	352	2.407
49. English Composition	343	2.652
50. Technical and Occupational Writing	346	2.508
51. Advanced Technical Communication	331	2.826
52. Fundamentals of Public Speaking . . .	338	2.955
53. Other (specify) ________________		
54. Other (specify) ________________	Average	2.670
HUMANITIES		
55. Art	287	3.919
56. Drama	286	3.970
57. Foreign Language	295	3.740
58. History	292	3.816
59. Humanities	299	3.558
60. Literature	289	3.803
61. Music	286	3.975
62. Other (specify) ________________		
63. Other (specify) ________________	Average	3.825

APPENDIX X CONTINUED

RATED SUBJECT MATTER AREA

TECHNICAL SUPPORT (CONTINUED)	Total Number of Responses	Rating
BEHAVIORAL SCIENCE		
64. Anthropology	286	3.952
65. Economics	311	3.164
66. Political Science	291	3.679
67. Psychology	307	3.308
68. Social Science	295	3.583
69. Sociology	292	3.583
70. Other (specify) ______		
71. Other (specify) ______	Average	3.545
NATURAL SCIENCES		
72. Astronomy	282	4.071
73. Fundamentals of Algebra	319	2.960
74. Intermediate Algebra	307	3.192
75. Biology	287	3.884
76. Chemistry	302	3.396
77. Geography	294	3.662
78. Geology	282	3.821
79. Physical Science	294	3.376
80. Physics	303	3.205
81. Trigonometry	293	3.487
82. Other (specify) ______		
83. Other (specify) ______	Average	3.505

APPENDIX XI

RANKED SUBJECT MATTER AREA RESPONSES FOR UPDATING CURRENT TECHNICIANS

O Trucking
D Construction
A Agriculture

TECHNICAL	O	D	A
1. Air Brake & Anti-Skid Trb-Sht	37	7	3
2. Air Conditioning (Vehicle) . .	13	2	16
3. Compressors (High Volume) . .	3	1	
4. Computerized Parts, Service and Planned Maintenance Sys	15	25	9
5. Electrical/Electronic Trb-Sht	52	69	36
6. Electronic Controls (Process/Digital)	25	72	16
7. Engine, Diesel; Computer Controlled Fuel Systems . .	47	23	17
8. Engine, Diesel; Fuel Injection Systems Trb-Sht	29	22	27
9. Engine Trb-Sht	23	22	18
10. Failure Analysis	12	28	13
11. Fleet Management	3	8	
12. Fuels and Lubricants	2	5	2
13. Generator Sets	2	3	1
14. Hydraulics, Advanced (Study of Various Systems)	7	39	21
15. Hydraulic Trb-Sht	3	47	27
16. Internships			
17. Marine Applications			
18. Materials Used in the Industry (Characteristics/Properties Of)	2	2	
19 Metallurgy	1	2	
20. Pneumatics	3	6	
21. Powershift & Automatic Transmissions Trb-Sht . . .	9	17	20
22. Safety	12	14	1
23. Steel Fabrication	5	4	
24. Suspension System Trb-Sht . .	11		
25. Tires, Rims and Safety		1	
26. Tracks		4	
27. Trailers	6		
28. Transport Refrigeration	2		
29. Specifications, Vehicle (Ordering and Writing)	1		
30. Welding	7	6	3

31. Other (specify) ________________
32. Other (specify) ________________
33. Other (specify) ________________
34. Other (specify) ________________

APPENDIX XI CONTINUED

RANKED SUBJECT MATTER AREA RESPONSES FOR UPDATING CURRENT TECHNICIANS

O Trucking
D Construction
A Agriculture

TECHNICAL SUPPORT	O	D	A
35. Accounting, Dealership	1	1	5
36. Accounting, Financial	2	1	1
37. Computer Aided Design, Begin .		2	2
38. Law, Business		2	2
39. Law, Labor		1	1
40. Laws and Regulations, OSHA . .	4	5	
41. Microcomputer Program Applications (General) . . .	2	3	3
42. Microcomputer Programming . .	1	2	
43. Risk Management		1	
44. Supervision and Leadership . .	9	17	4
45. Other (specify) ______________			
46. Other (specify) ______________			
47. Other (specify) ______________			
ENGLISH			
48. English Grammar	4	9	3
49. English Composition	3	6	1
50. Technical and Occupational Writing	5	11	3
51. Advanced Technical Communication	2	7	
52. Fundamentals of Public Speaking		5	1
53. Other (specify) ______________			
54. Other (specify) ______________			
HUMANITIES			
55. Art			
56. Drama			
57. Foreign Language		1	
58. History			
59. Humanities	1		1
60. Literature			
61. Music			
62. Other (specify) ______________			
63. Other (specify) ______________			

APPENDIX XI CONTINUED

RANKED SUBJECT MATTER AREA RESPONSES FOR UPDATING CURRENT TECHNICIANS

O Trucking
D Construction
A Agriculture

TECHNICAL SUPPORT (CONTINUED)

BEHAVIORAL SCIENCE	O	D	A
64. Anthropology	1		
65. Economics	3		1
66. Political Science			
67. Psychology	1		2
68. Social Science			
69. Sociology	1		2
70. Other (specify) ______			
71. Other (specify) ______			

NATURAL SCIENCES	O	D	A
72. Astronomy			
73. Fundamentals of Algebra	1	1	
74. Intermediate Algebra	1	3	
75. Biology			
76. Chemistry	1		
77. Geography			
78. Geology		2	
79. Physical Science			
80. Physics		2	
81. Trigonometry		1	
82. Other (specify) ______			
83. Other (specify) ______			

APPENDIX XI CONTINUED

RANKED SUBJECT MATTER AREA RESPONSES FOR UPDATING CURRENT TECHNICIANS

J Mining K Oil Field
P Utilities G Government
H Military/Defense

TECHNICAL	JK	P	GH
1. Air Brake & Anti-Skid Trb-Sht	1	4	6
2. Air Conditioning (Vehicle) . .	1		1
3. Compressors (High Volume) . .			
4. Computerized Parts, Service and Planned Maintenance Sys	6	4	7
5. Electrical/Electronic Trb-Sht	16	6	14
6. Electronic Controls (Process/Digital)	10	2	8
7. Engine, Diesel; Computer Controlled Fuel Systems . .	7	6	12
8. Engine, Diesel; Fuel Injection Systems Trb-Sht	4	5	6
9. Engine Trb-Sht	6	5	4
10. Failure Analysis	4	3	4
11. Fleet Management			3
12. Fuels and Lubricants	1	1	
13. Generator Sets	1		
14. Hydraulics, Advanced (Study of Various Systems)	8	8	9
15. Hydraulic Trb-Sht	10	4	3
16. Internships			
17. Marine Applications			
18. Materials Used in the Industry (Characteristics/Properties Of)			1
19 Metallurgy	1		
20. Pneumatics	1		1
21. Powershift & Automatic Transmissions Trb-Sht . . .	5	2	2
22. Safety	5	3	3
23. Steel Fabrication	1		2
24. Suspension System Trb-Sht . .		3	
25. Tires, Rims and Safety			1
26. Tracks		1	
27. Trailers			
28. Transport Refrigeration . . .			
29. Specifications, Vehicle (Ordering and Writing) . . .			2
30. Welding	2	1	2

31. Other (specify) ________________
32. Other (specify) ________________
33. Other (specify) ________________
34. Other (specify) ________________

APPENDIX XI CONTINUED

RANKED SUBJECT MATTER AREA RESPONSES FOR UPDATING CURRENT TECHNICIANS

J Mining
K Oil Field
P Utilities
G Government
H Military/Defense

TECHNICAL SUPPORT	JK	P	GH
35. Accounting, Dealership			
36. Accounting, Financial			1
37. Computer Aided Design, Begin .			
38. Law, Business	1		
39. Law, Labor			
40. Laws and Regulations, OSHA . .	2		2
41. Microcomputer Program Applications (General) . . .	2		2
42. Microcomputer Programming . .			1
43. Risk Management	1		
44. Supervision and Leadership . .	2	1	3
45. Other (specify) ____________			
46. Other (specify) ____________			
47. Other (specify) ____________			
ENGLISH			
48. English Grammar			
49. English Composition			
50. Technical and Occupational Writing	4	2	3
51. Advanced Technical Communication	1		1
52. Fundamentals of Public Speaking			
53. Other (specify) ____________			
54. Other (specify) ____________			
HUMANITIES			
55. Art			
56. Drama			
57. Foreign Language			
58. History			
59. Humanities			
60. Literature			
61. Music			
62. Other (specify) ____________			
63. Other (specify) ____________			

APPENDIX XI CONTINUED

RANKED SUBJECT MATTER AREA RESPONSES FOR UPDATING CURRENT TECHNICIANS

J Mining
K Oil Field
P Utilities
G Government
H Military/Defense

TECHNICAL SUPPORT (CONTINUED)

BEHAVIORAL SCIENCE	JK	P	GH
64. Anthropology			
65. Economics			1
66. Political Science			
67. Psychology	1		
68. Social Science			
69. Sociology			
70. Other (specify) ________			
71. Other (specify) ________			

NATURAL SCIENCES	JK	P	GH
72. Astronomy			
73. Fundamentals of Algebra . . .	1		1
74. Intermediate Algebra			
75. Biology			
76. Chemistry	1		
77. Geography			
78. Geology			
79. Physical Science			
80. Physics			
81. Trigonometry			
82. Other (specify) ________			
83. Other (specify) ________			

APPENDIX XI CONTINUED

RANKED SUBJECT MATTER AREA RESPONSES FOR UPDATING CURRENT TECHNICIANS

G Marine M Refrigeration
N Standby Power H Material Handling
E Forestry

TECHNICAL	GMN	H	E
1. Air Brake & Anti-Skid Trb-Sht	1		1
2. Air Conditioning (Vehicle) . .	2		
3. Compressors (High Volume) . .			
4. Computerized Parts, Service and Planned Maintenance Sys	2	6	2
5. Electrical/Electronic Trb-Sht	8	17	7
6. Electronic Controls (Process/Digital)	3	8	2
7. Engine, Diesel; Computer Controlled Fuel Systems . .	4	3	3
8. Engine, Diesel; Fuel Injection Systems Trb-Sht	1	1	2
9. Engine Trb-Sht	5	7	1
10. Failure Analysis		4	4
11. Fleet Management	2	2	
12. Fuels and Lubricants			1
13. Generator Sets	10	1	1
14. Hydraulics, Advanced (Study of Various Systems)		5	4
15. Hydraulic Trb-Sht	1	4	5
16. Internships			
17. Marine Applications	2		
18. Materials Used in the Industry (Characteristics & Properties Of)			1
19. Metallurgy		1	1
20. Pneumatics	1	2	
21. Powershift & Automatic Transmissions Trb-Sht . . .	1	7	1
22. Safety	2	3	
23. Steel Fabrication		1	1
24. Suspension System Trb-Sht . .			
35. Tires, Rims and Safety			
26. Tracks			1
27. Trailers	1		
28. Transport Refrigeration	2		
29. Specifications, Vehicle (Ordering and Writing) . . .		3	
30. Welding		3	1
31. Other (specify) ______________			
32. Other (specify) ______________			
33. Other (specify) ______________			
34. Other (specify) ______________			

APPENDIX XI CONTINUED

RANKED SUBJECT MATTER AREA RESPONSES FOR UPDATING CURRENT TECHNICIANS

G Marine
M Refrigeration
N Standby Power
H Material Handling
E Forestry

TECHNICAL SUPPORT	GMN	H	E
35. Accounting, Dealership	1	1	
36. Accounting, Financial			
37. Computer Aided Design, Begin.	1	1	
38. Law, Business		1	
39. Law, Labor			
40. Laws and Regulations, OSHA . .	1		1
41. Microcomputer Program Applications (General) . . .	1	2	
42. Microcomputer Programming . .		1	
43. Risk Management	1	1	
44. Supervision and Leadership . .	1	4	
45. Other (specify) ____________			
46. Other (specify) ____________			
47. Other (specify) ____________			
ENGLISH			
48. English Grammar	2	1	
49. English Composition		1	
50. Technical and Occupational Writing		3	2
51. Advanced Technical Communication	1	3	1
52. Fundamentals of Public Speaking			
53. Other (specify) ____________			
54. Other (specify) ____________			
HUMANITIES			
55. Art			
56. Drama			
57. Foreign Language			1
58. History			
59. Humanities			
60. Literature			
61. Music			
62. Other (specify) ____________			
63. Other (specify) ____________			

APPENDIX XI CONTINUED

RANKED SUBJECT MATTER AREA RESPONSES FOR UPDATING CURRENT TECHNICIANS

G Marine
M Refrigeration
N Standby Power
H Material Handling
E Forestry

TECHNICAL SUPPORT (CONTINUED)

BEHAVIORAL SCIENCE	GMN	H	E
64. Anthropology			
65. Economics	1	1	
66. Political Science			
67. Psychology	1	1	
68. Social Science			
69. Sociology			
70. Other (specify) ______			
71. Other (specify) ______			
NATURAL SCIENCES			
72. Astronomy			1
73. Fundamentals of Algebra			
74. Intermediate Algebra	1		1
75. Biology			
76. Chemistry			
77. Geography			1
78. Geology			
79. Physical Science			1
80. Physics			1
81. Trigonometry			
82. Other (specify) ______			
83. Other (specify) ______			

APPENDIX XI CONTINUED

RANKED SUBJECT MATTER AREA RESPONSES FOR UPDATING CURRENT TECHNICIANS

B Air Transportation
C Bus Transportation
L Railroad

TECHNICAL	BCL	Totals
1. Air Brake & Anti-Skid Trb-Sht		60
2. Air Conditioning (Vehicle) . .	1	36
3. Compressors (High Volume) . .		4
4. Computerized Parts, Service and Planned Maintenance Sys	3	79
5. Electrical/Electronic Trb-Sht	6	231
6. Electronic Controls (Process/Digital)	1	108
7. Engine, Diesel; Computer Controlled Fuel Systems . .	4	128
8. Engine, Diesel; Fuel Injection Systems Trb-Sht	4	106
9. Engine Trb-Sht	5	97
10. Failure Analysis	4	79
11. Fleet Management		18
12. Fuels and Lubricants		12
13. Generator Sets	1	20
14. Hydraulics, Advanced (Study of Various Systems)	3	116
15. Hydraulic Trb-Sht	2	107
16. Internships		
17. Marine Applications	1	3
18. Materials Used in the Industry (Characteristics/Properties Of)	1	7
19 Metallurgy		6
20. Pneumatics	1	15
21. Powershift & Automatic Transmissions Trb-Sht . . .	1	66
22. Safety	1	44
23. Steel Fabrication		14
24. Suspension System Trb-Sht . .		14
25. Tires, Rims and Safety		2
26. Tracks		6
27. Trailers		7
28. Transport Refrigeration . . .		4
29. Specifications, Vehicle (Ordering and Writing) . . .		6
30. Welding		25
31. Other (specify) ____________		
32. Other (specify) ____________		

APPENDIX XI CONTINUED

RANKED SUBJECT MATTER AREA RESPONSES FOR UPDATING CURRENT TECHNICIANS

B Air Transportation
C Bus Transportation
L Railroad

TECHNICAL SUPPORT	BCL	Totals
35. Accounting, Dealership		9
36. Accounting, Financial		5
37. Computer Aided Design, Begin.		7
38. Law, Business		6
39. Law, Labor		2
40. Laws and Regulations, OSHA . .		15
41. Microcomputer Program Applications (General) . . .		15
42. Microcomputer Programming . .		5
43. Risk Management		4
44. Supervision and Leadership . .	2	44
45. Other (specify) ____________		
46. Other (specify) ____________		
47. Other (specify) ____________		
ENGLISH		
48. English Grammar		19
49. English Composition		11
50. Technical and Occupational Writing	1	34
51. Advanced Technical Communication	1	17
52. Fundamentals of Public Speaking		6
53. Other (specify) ____________		
54. Other (specify) ____________		
HUMANITIES		
55. Art		
56. Drama		
57. Foreign Language		2
58. History		
59. Humanities		2
60. Literature		
61. Music		
62. Other (specify) ____________		
63. Other (specify) ____________		

APPENDIX XI CONTINUED

RANKED SUBJECT MATTER AREA RESPONSES FOR UPDATING CURRENT TECHNICIANS

B Air Transportation
C Bus Transportation
L Railroad

TECHNICAL SUPPORT (CONTINUED)

BEHAVIORAL SCIENCE	BCL	Totals
64. Anthropology		1
65. Economics		6
66. Political Science		
67. Psychology		6
68. Social Science		4
69. Sociology		2
70. Other (specify) ____		
71. Other (specify) ____		
NATURAL SCIENCES		
72. Astronomy		1
73. Fundamentals of Algebra	1	5
74. Intermediate Algebra	1	7
75. Biology		
76. Chemistry		2
77. Geography		1
78. Geology		1
79. Physical Science	1	2
80. Physics	1	4
81. Trigonometry	1	2
82. Other (specify) ____		
83. Other (specify) ____		

APPENDIX XII

AGRICULTURE INDUSTRY COMMENTS

We, as a farm equipment dealer, would like to see a part of your program geared toward Agricultural equipment repair. There is a growing need for this type of technician, and any type of training is appreciated.

Send this in winter and I might have time to look at it.

APPENDIX XIII

BUS/RAILROAD TRANSPORTATION INDUSTRY COMMENTS

Work Equipment Training Program of Instruction

COURSE NUMBER:	ENG 804
COURSE TITLE:	Basic Mechanical Skills for Work Equipment
COURSE LENGTH:	A Continuing Program Taught in Modules of Varying Lengths.
APPROVAL DATE:	
SUPERSESSION INFORMATION:	
DESIGNED AND DEVELOPED BY:	Technical Training Division

Course Administrative Data

PREPARATION DATE:	
COURSE NUMBER:	ENG 804
TITLE:	Basic Mechanical Skills Program for Work Equipment Repairer
TRAINING LOCATION:	
PURPOSE:	To provide basic mechanical skills training for Work Equipment Repair Personnel so that they may obtain the skills and knowledge necessary to efficiently perform the required maintenance services and repairs on company work equipment.
SCOPE:	This course provides basic mechanical skills training in maintenance concepts, safety, hand tools, precision measuring instruments, welding, gasoline, and diesel engine fundamentals and

engine systems, hydraulics, pneumatics, electricity, power trains, brakes, scheduled services, and the use of Test, Measurement and Diagnostic Equipment. Successful completion of this course will enable these personnel to properly service, repair and/or replace the components of the above systems and related attachments on company work equipment.

PREREQUISITES: None

DATA:
Course Length: Maximum 6
Class Size: Minimum 3

ACADEMIC HOURS:
DEVELOPED:

TRAINING START DATE: TBA

TRAINING DEVELOPMENT
PROPONENT: Technical Training Division

Course Summary

COURSE: Basic Mechanical Skills for Work Equipment Repairer

ACADEMIC TIME:

Module A: Maintenance Practices and Safety Procedures

Module B: Internal Combustion Engines

Module C: Hydraulics

Module D: Pneumatics

Module E: Electricity

Module F: Power Trains and Related Systems

Module G: Wheels, Axles and Truck Assemblies

Module H: Brakes

Module I: Scheduled Services

APPENDIX XIV

CONSTRUCTION INDUSTRY COMMENTS

Humanities, Behavioral Science, and Natural Sciences are not directly important to their job, but they still should have some basic humanities for themselves.

Humanities, Behavioral Science, and Natural Sciences - we appreciate a well-rounded person who enjoys a full life, but these subjects are not essential to their daily work.

I don't dig this question - how in the hell could biology or astronomy possibly relate to the job performance of a mechanic.

English - must communicate.
Behavioral Science - understand people and how to treat them.
I put emphasis on technical training. My industry must perform the work (reg'd mechanics) and must be able to communicate with management as well as our clients. They also make much better employees if they understand the economics of our industry. Good service personnel are hard to find. Average personnel are easy to find.

Humanities - Minimal Spanish
Look at areas of required concentration for survival in international competition and back into courses VII X. Please identify the five most important subject areas, from question VI, in which your current technicians will need additional skills and knowledge to meet projected job requirements within the next five years:

1. Fundamental communication skills
2. Fundamental business skills
3. Strong grasp of physical science and basic engineer
4. International business exposure
5. Computer and electronics fluency

Present employees are not promotable to service department supervisory positions because they cannot read and write correctly. This is true for most of our present people. Let's demand that a H.S. Graduate prove he/she can read and write. We all better learn Spanish and Japanese.

Will you please send me a catalog of courses for your university.

Communication skills also are important.

You are right on! We need trained service people very badly in the entire construction machinery industry.

As far as construction equipment goes the number one thing needed is to become more familiar with foreign products.

I believe the industry would be better served with the continuation of the two year Associate Degree program.

The outlined four year course would prepare the student for a management role which in a large company would almost certainly be filled by a Business Administration graduate. The divisional head in most case is underpinned with an individual who has worked his way up through the ranks, and who ideally would be in possession of a two year associate degree. You require substantial hands-on experience to manage a shop and a competent shop manager seldom has a high educational background unless there is a military background.

Regrettably, in the United States, the person inclined to the heavy equipment service industry will have little more than a high school diploma, and the person inclined to science and technology will have been steered away from our industry by his education. Deplorable but true!

I have enclosed your survey for determining the educational and training needs of the heavy equipment service industry.

At your option, if you would periodically send me a list of those who are seeking employment, I will forward that information to our dealers.

I cannot over-stress the importance of development of good electronic design and troubleshooting technicians. There are a fair number of technicians in the marketplace that are skilled on power train and basic electrical design, trouble-shooting, and repair.

There is a major void in the area of having skilled technicians to trouble-shoot and repair electronically controlled injection pumps, transmissions hydraulic systems, etc. Dealers and end users of this equipment pay the penalty in terms of major component replacement and excessive machine downtime as few if any have the ability to correctly diagnose and make a timely cost effective repair.

Thank you for your interest in identifying actual needs as you embark on expanding your curriculum.

As a manufacturer, we do not have a great need for people with this background. Our dealers and their customers would have a greater need for technicians. It was with their needs in mind that I answered question VI.

I have recently hired a graduate from your program to institute an equipment management and maintenance program at my facility. We are just starting to implement the program and hoping to see good results through this construction season.

Except for those items checked, most others are disciplines that will be eventually incorporated into various articles about machinery.

While the technical slant of magazine articles remains important, the principles of management are becoming more important as competition increases among machine owners. These are subjects I need to learn more about.

I strongly recommend against trying to establish a 4 year program for individuals who will be repair techs. I would not hire a 4 year grad.

VII & IX are too broad - we need people with the good technical background that have good people skills. People with pure technical background have no training to be managers.

Aeroquip Industrial Connectors Division Only:
I compliment your efforts. We may be able to help you in the future.

VI 31. How to discuss failure details with customers (do's & don'ts).
32. Read electronic schematics.
53. Communicate with customer.

4/30/89
ADDITIONAL COMMENTS:

Glad to hear your curriculum will include more indepth study of electrical/electronics. We need to add more exposure to a working knowledge of electronic schematics.

Your hydraulic trouble-shooting curricula should also include training on how to read hydraulic schematics.

Would like air-condition servicing taught to all candidates; also welding technology. Not necessary to be certified - we can get this credential for the candidate.

APPENDIX XV

ENGINE INDUSTRY COMMENTS

I'm at ________________. We hire a number of new college grads each year. I'm not in a position to know what our curent training plans are as we have many different areas of concentration within our company.

APPENDIX XVI

FORESTRY INDUSTRY COMMENTS

Because our company operates a series of remote camps, we might expect a higher turn-over rate as employees move "back to town" to fill the social void that occurs naturally when one is isolated for long terms. For this reason we would expect to employ several individuals for one or two year terms although we have many permanent employees.

We now employ 3 - 4 graduates of Oregon Institute of Technology yearly and have a high regard of the program for entry level workers.

The industry void seems to be in diagnostic & problem solving skills along with applied failure analysis preventing reoccuring failures using preventive measures or predicting accurate life cycles.

Predictive tools such as oil samples & frequent inspections & records accumulating data must replace crisis management employed after a failure.

All technicians need to be effective communicators.

APPENDIX XVII

STANDBY POWER INDUSTRY COMMENTS

1. How do you attract your students?
2. Do you have a sales force?

90% of our work is performed in the field. The ability of a technician to work under many different conditions is important. Common sense & the ability to work independently. Reading & understanding wire drawings & technical factory information.

We work on every engine, generator, transfer/switch manufactured, basics relate to all, specifics are varied. Our technicians need to be able to relate to these elements of their job. Most times the technical information is behind new models already in the field.

APPENDIX XVIII

HYDRAULICS/PNEUMATICS INDUSTRY COMMENTS

This industry could use a correspondence course for AAS or BS candidates. I might change the way I intend to develop people if such were available.

APPENDIX XIX

MATERIAL HANDLING INDUSTRY COMMENTS

Courses in sales skills needed.

50% DIESEL TECHNOLOGY/HYDRAULICS
50% BUSINESS CLASSES/HUMANITIES NATURAL SCIENCE
BA/BS

As a distributor of fork lift trucks with 100 independent dealers we need entry level people trained in:

- general business
- sales & marketing
- technical writing
- social science
- computers, general
- gas & diesel
- hydraulics
- suspension/steering
- brakes
- manufacturing materials & problems

CAREER PATH

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L----------------------------------------DEPT. MANAGER
E---------------------------SALES REP.
V-----------------SERV. REP.
E-------WARRANTY
L
S       1         2         3        4      5    6  >  10
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Our experience indicates most technical schools are treating mechanics as hands-on training rather than theory and applied science. A well trained mechanic should posses the skills to think in a deductive approach to problem solving that "hands-on experience alone cannot provide." With industry constantly changing, a mechanic without a good background in all facets of operation will be ill-equipped to handle the rapid change he will encounter.

APPENDIX XX

MUNICIPALITY/STATE/FEDERAL GOVERNMENT COMMENTS

SUGGESTION:

Many municipal or governmental fleets are faced with owning and maintaining a very wide variety of brands of equipment and vehicles. Also, government operations have the largest diversity of vehicle, equipment, and tools to manage, maintain, and attempt to track O & M costs. Technicians on support staff, going through an institutional program, need to be exceptionally adaptive and receptive to this wide prospect and challenge. Many technicians may spend their entire working career trying to be the best technician they can be on <u>one brand</u>. Minicipal fleet technicians and staff usually are expected to be experts on all brands and all vehicles, equipment, and associated tools. This is truly not possible, but requires good mental prepareness to deal with the "customer's" expectations. Thanks for this opportunity!

This questionnaire addresses many of the issues that we as administrators face in our industry. Unfortunately too many technicians have never received the proper instructions on repair and maintenance and then, if they show a little initiative, they are promoted to a position in which they have no management skills. Sometimes this deficiency is overcome, but in most cases the person fails miserably and upper management can't understand why.

A recent survey I did for the Florida Association of Governmental Fleet Administrators indicates that the good managers in our industry have two basic things going for them:

1. They have a strong background in the automotive industry.
2. They have an upper level education with strong emphasis on managerial skills.

I would very much like to see Ferris offer the B.S. Degree, provided it includes many management and business courses. Writing skills are also very important, however, the humanities courses are extremely useless in our industry. I only wish that the B.S. Degree was available to me at the time I received my AAS from Ferris. I have since gone on to get my B.S. in Professional Management from Nova University.

Fleet Administration is a science. It involves all the facets of management, business and technical skills. Our industry is in dire need of trained professionals who have these skills. If Ferris offers this program, it will indeed help the growing need for these professionals.

All cities need an expert in fleet management and maintenance. A city's fleet is usually it's largest investment expense.

Most cities do not have the money to send their personnel to distant seminars and schools. I believe Educational Training consultants could be of unlimited value in training technicians locally. In this approach more technical personnel could be exposed to valuable training information.

Please accept my apology for this reply being so late.

APPENDIX XXI

TRUCKING INDUSTRY COMMENTS

My company is strictly involved with wheel alignment - frame straighting - rebuilding suspensions & brake service.

Note: We're a small independent transmission parts and service facility.

I need <u>night courses</u> set up so I can run my mechanics through without disrupting my work schedule. I called late in 1989 and was told they were not available at that time. These classes need to be one night a week, going for 6-8 weeks. I would have a constant number of mechanics going through them if they were set up. Please call me if this gets set up.

The need for trained mechanics with a positive attitude is very important. Electrical fuel systems with R.P.M., idle time and cruise control to control fuel usage is one of the strongest forces today. Brakes and electrical shorts and opens is also strong.

Please note that this company is very specialized in braking & suspension systems.

We are an automotive, light truck dealership. This survey really does not apply to us.

APPENDIX XXII

UTILITY INDUSTRY COMMENTS

QUESTION VII: Impossible to answer as we have so many professions involved. We have machinists and welders, refrigeration mechanics, hydraulic mechanics, heavy equipment mechanics, designers and engineers involved in our heavy equipment operations. Each would have a different perspective as to which subject was most important.

QUESTION VII - Theory and trouble shooting of the various vehicle equipment systems-->

I would like to see a 2 year at school program followed by a 1 or 2 year internship with the employer providing the intermediate to higher applications of practical work with the school supplementing the technical support needed.

I feel a 4 year academic program would be a financial burden for most persons interested in the mechanic field. If I were to spend 4 years at school, I would not want to start as a mechanic.

What our industry needs is people who can come in and start doing competent basic mechanical repairs. If they have been given a good theory background, the application of that theory can come later thru manufacturers or distributors for the specifics of the various systems.

APPENDIX XXIII

MINING INDUSTRY COMMENTS

QUESTION 10: It's too limiting to list only the five most important items, as quite a few more are equally important in measuring technicians' performance.

The thrust these days of course _is_ to be _multi-skilled_ and cross-trained to allow greater flexibility in job assignments.

April 30, 1990

To be able to come into a maintenance shop like ours, a person must have a fundamental knowledge of how engines, transmissions, hydraulic systems, electrical systems, drive trains, brake systems, and air systems work. All equipment uses these systems, however different manufacturers have different ways of doing things. But the fundamentals do not change and if these are thoroughly learned, most problems can be solved.

Electronics and computer controls are being used more and more to control components, so this area is becoming more important.

Good, simple record keeping is very important and should be included in some way in the system.

It is good to see you are offering a program in this area. We feel it definitely is needed and if there is anything else we can do to help, please let us know.