1992

1992 Projects Day Booklet

Seattle University

Seattle University
School of Science and Engineering
Engineering Design Center

PROJECTS DAY
June 5, 1992

Welcome

Once again our senior engineering students have the opportunity to present the design projects they have completed during the 1991-92 academic year. These projects represent the cumulative efforts of liaison engineers from the sponsoring organizations, participating students and faculty advisers.

The overall administration of the Engineering Design Center is under the able direction of Dr. Rolf Skrinde. He is assisted in coordinating departmental efforts through the offices of Professor Arthur Benedict, civil and environmental engineering, Professor Al Moser, electrical engineering, and Professor Ray Murphy, mechanical engineering.

Projects Day provides an opportunity to see and hear about the design of materials, equipment and processes that are relevant to the sponsoring organization and can be useful components of our working world. These projects have provided an excellent learning experience for our students, and we trust they are of interest to you.

Our sincere thanks for joining us today. For many of you, this visit has become an annual event. For others, it may be your initial encounter. In either case, we appreciate your participation and trust you will enjoy the day with us at Seattle University

Dale A. Carlson, Dean
School of Science and Engineering

On behalf of our engineering faculty and students, may I welcome you to Projects Day 1992, our fifth annual reporting of design team results to sponsoring organizations, visitors and friends. For academic year 1991-92, we are pleased that all of our 24 senior engineering design projects are sponsored by industry and other organizations, and we are grateful for this fine support.

I would also like to take this opportunity to acknowledge the encouragement and assistance provided by our dean and departmental engineering and science advisory boards in promoting the sponsorship of projects. Over the past five years they have been a major factor in helping us achieve our goal of industrial sponsorship of all the design projects.

On the recommendation of project sponsors, we have accelerated our program of summer internships this year. Past experience has shown that when internship students return as seniors they are better prepared to carry out projects, especially those that may be sponsored by their summer employers. We thank you for these types of suggestions, and encourage your continuing feedback to improve our engineering design program.

Rolf T. Skrinde, Director
Engineering Design Center

Projects Day

10:00 a.m. ..... Projects Day Registration and Tours

11:00 a.m. ..... Project Presentations

Wyckoff Auditorium

- Restoration of a Five Acre Site Along the Duwamish Waterway, Seattle
- Interim Covers for Low Level Burial Ground Trenches at the Hanford Site, Richland
- Ferry Terminal Computer Analysis for Overweight Vehicles
- Electrical Underground Distribution System for a Capitol Hill Subdivision, Seattle

Bannan Auditorium

- Design of Sigma-Delta A/D Converter
- Resistance Standard PCA and Enclosure for a Multi-Standard Calibrator
- Design of a Wireless Patient Connection for a Portable Defibrillator/Monitor
- Analysis and Redesign of a Creepage Monitor for Bimetal Thermal Switches

12:00 p.m. ..... Lunch in the Engineering Building Gallery

1:15 p.m. ..... Project Presentations

Wyckoff Auditorium

- East Sammamish Plateau Arterial Near Issaquah, Washington
- Temperature Pressure Potential Amplifier
- Pick-Up Mechanism for a Segment Erector
- Torque Tube Coupling
- Universal Clamping System for a Truck Cab Durability Shaker
- Dynamic Behavior of Printed Wire Assemblies
- Kenworth Crossover Fuel Line Design Study

Bannan Auditorium

- Design for Testability Module Development
- Design of a SONET OC-3 Overhead Byte Basic Indication Test Set
- Heater Installation in Power Circuit Breakers
- JTAG Test Set for ASIC and AU 4 Arithmetic Unit
- Design of an IEEE Single Precision Floating Point Square Root/Divide Module for ChipCrafter
- Data Acquisition Software for the U.S. Public Health Service's National Medical Database
- Transformer Modeling and Short Circuit Current Studies
- Graphics Project
- Fiber Optic System CAE Development

Refreshment break between 2:30 and 3:00 p.m., as appropriate, in the Engineering Building Gallery

Wyckoff Auditorium
11:00 a.m.

PROJECT TITLE:	Restoration of a Five Acre Site Along the Duwamish Waterway, Seattle
SPONSOR:	**Port of Seattle — Seattle, Washington**
LIAISON ENGINEER:	**George Blomberg**
FACULTY ADVISER:	Prof. Arthur Benedict
STUDENTS:	Jerrod Davis, Todd Lloyd, Julia Richart, Julia Ruzon, Travis Tormanen

DESCRIPTION:
The team designed and made recommendations for the restoration of a five acre industrial-fill site on the Duwamish River. Working in conjunction with the Port and its contractors, the team assessed the degree of site contamination and evaluated alternatives for disposal of contaminated and uncontaminated soil from the site. Methods and costs for removal and disposal of three derelict barges also were determined. Fish and wildlife habitat requirements for site restoration were developed, and a preliminary site restoration plan was prepared.

PROJECT TITLE:	Interim Covers for Low Level Burial Ground Trenches at the Hanford Site, Richland
SPONSOR:	**Westinghouse Hanford Company — Richland, Washington**
LIAISON ENGINEER:	**Barbara Broomfield**
FACULTY ADVISER:	Prof. Rolf Skrinde
STUDENTS:	Mark Bock, Dan McGrath, Ed Mulhern

DESCRIPTION:
The team designed interim covers for trenches used over the past several decades for disposal of low level transuranic wastes at the Hanford nuclear reservation. The wastes are presently containerized in drums and boxes, and the trenches are backfilled with approximately six feet of soil. The covers must minimize intrusion of precipitation into the waste, must not interfere with the construction/filling of other trenches, and must be easily removable for the eventual recovery of disposed transuranic wastes.

PROJECT TITLE: Ferry Terminal Computer Analysis for Overweight Vehicles
SPONSOR: **Washington State Department of Transportation, Marine Division — Seattle, Washington**
LIAISON ENGINEER: **Joel Colby**
FACULTY ADVISER: Prof. Richard Schwaegler
STUDENTS: John Bickford, Tony DelGianni, Gayle Graham, Alireza Mohammadi

DESCRIPTION:
The design team modified an existing ferry terminal computer analysis program for overweight vehicles to include 1957 vintage transfer spans. Analyses also included a new module to analyze timber trestles at ferry terminals. The trestle analysis module considered the following critical items:

1. bending and shear in glulam decking
2. bending and shear capabilities of stringers
3. bending, shear, and crushing capabilities of pile caps
4. axial load capacity in the piles.

The program focussed on data provided for the two longest, consecutive bents of the trestle.

PROJECT TITLE: Electrical Underground Distribution System for a Capitol Hill Subdivision, Seattle
SPONSOR: **Seattle City Light — Seattle, Washington**
LIAISON ENGINEERS: **Dave Russo and Ashok Nayudu**
FACULTY ADVISER: Prof. Arthur Benedict
STUDENTS: Scott Liang, Susan Venard, Douglas Yuhl

DESCRIPTION:
The project objective was to design electrical load requirements and location of an underground electrical distribution system in the Capitol Hill area of Seattle. Current land uses and proposed or anticipated land uses were examined to verify electrical loads. Existing utilities and site improvements were considered in designating locations of the underground electrical system, so as to minimize public disruptions and cost of installation and maintenance. The design product included a complete set of plans detailing the proposed installation of the underground electrical distribution system, in accordance with applicable specifications.

Wyckoff Auditorium
1:15 p.m.

PROJECT TITLE:	East Sammamish Plateau Arterial Near Issaquah, Washington
SPONSOR:	**Parsons, Brinckerhoff, Quade, and Douglas, Inc. — Seattle, Washington**
LIAISON ENGINEER:	**Susan Heutmaker**
FACULTY ADVISER:	Prof. Rolf Skrinde
STUDENTS:	Gunawan Kantono, Tuan Tran, Man Truong

DESCRIPTION:
The design team located a new arterial for the East Sammamish Plateau community, which will connect with I-90 in the Issaquah vicinity. Technical, land use, and environmental issues were addressed in locating the arterial. The project had to meet King County roadway design standards, as well as state environmental criteria. Existing residential areas, steeply sloped topography, sensitive wetlands and potential erosion hazards contributed to a complex design process.

PROJECT TITLE:	Temperature Pressure Potential Amplifier
SPONSOR:	**Ralph C. Schlichtig — Seattle, Washington**
LIAISON ENGINEER:	**Ralph C. Schlichtig**
FACULTY ADVISER:	Prof. Jack Mattingly
STUDENTS:	Bill Brown, Joe Clarke, Scott Henderson, Tuan Hoang

DESCRIPTION:
The Temperature Pressure Potential Amplifier (TEPPA) power cycle is a Rankine type cycle that is meant to produce usable power from waste heat. The TEPPA modification is used to shift a traditional high temperature source to a lower, readily available temperature. The goal of the project was to design, build, and test the TEPPA modification to a Rankine cycle.

PROJECT TITLE: Pick-up Mechanism for a Segment Erector
SPONSOR: **The Robbins Company — Kent, Washington**
LIAISON ENGINEER: **Tom Soran**
FACULTY ADVISER: Prof. Pierre Gehlen
STUDENTS: Katherine Gendreau, Leonard Guan, Carlos Ordoña, Daniel Kushman

DESCRIPTION:
The objective of this project was to design a lifting mechanism for use on the segment erector of a soft earth tunnel boring machine. This mechanism lifts and retains the key segment for placement into the tunnel lining ring. It provides a method of raising the segment away from the pick-up pan for clearance, while withstanding heavy side loads. The mechanism will mount to the existing segment erector and must not interfere with its present mode of operation.

PROJECT TITLE: Torque Tnbe Coupling
SPONSOR: **Boeing Commercial Airplane Group — Seattle, Washington**
LIAISON ENGINEERS: **Arun K. Trikha, Ray St. Cyr, Ruth Clarke**
FACULTY ADVISER: Prof. Dennis Wiedemeier
STUDENTS: Debbie Descovich, Brian Schumacher, William Stagi

DESCRIPTION:
Since the early 1960s, the Boeing Company has used a particular method of maneuvering the wing flaps on all its commercial airplanes. The wing flaps are driven by gear boxes which in turn are motor driven. Power is transmitted from the motors to the gear boxes through torque tubes (drive shafts). The torque tubes are connected to the motors and to the gear boxes using a coupling device, which performs three basic functions: It transmits torque, it accommodates angular misalignment, and it compensates for end movement. While the current design has been highly reliable, Boeing believes that new materials and manufacturing or design technologies may now support the design of a lighter, less expensive coupling. A new coupling was designed in accordance with specifications provided by Boeing.

PROJECT TITLE: Universal Clamping System for a Truck Cab Durability Shaker
SPONSOR: **PACCAR Technical Center — Mt. Vernon, Washington**
LIAISON ENGINEER: **Gary Kramer**
FACULTY ADVISER: Prof. Lewis Filler
STUDENTS: Shelli Hansen, Robert Lardy, Dano Marith, Mark Traub

DESCRIPTION:
The team designed a universal frame clamping system for attaching actuator swivel heads to cab frame rails. The clamping system is to be attached to the frame rails in such a way that the vertical input loads from the actuator will pass through the shear centers of the frame rail channel sections. The clamping system must be attached to the frame rails without drilling the rails. The clamp was designed, manufactured and tested for function and durability.

PROJECT TITLE: Dynamic Behavior of Printed Wire Assemblies
SPONSOR: **Boeing Aerospace and Electronics — Seattle, Washington**
LIAISON ENGINEER: **Marc Klakken**
FACULTY ADVISER: Prof. Ray Murphy
STUDENTS: Melanie Burkhardt, Linda Johannessen, Jeffrey Kollgaard, Anhvu Pham

DESCRIPTION:
The Boeing Electronic Packaging Group uses computer-based finite element analysis (FEA) modeling techniques to predict and analyze the dynamic behavior of Printed Wire Assemblies (PWAs) when subjected to severe vibration environments. The representation of the boundary conditions, the method of supporting the PWAs, significantly impacts their dynamic response to vibration. Predictions of dynamic performance can be improved if the boundary conditions are more accurately represented. The design team developed a more accurate model of the boundary conditions and designed a test fixture for tests to verify predictions made by the model. Test results were analyzed using Fast Fourier Transform (FFT) techniques.

PROJECT TITLE: Kenworth Crossover Fuel Line Design Study
SPONSOR: **Kenworth Truck Company — Seattle, Washington**
LIAISON ENGINEER: **Ken Shearn**
FACULTY ADVISER: Prof. Stephen Robel
STUDENTS: Chris Ferguson, Glenn Heitman, Victor Pedroni, Scott Thunem

DESCRIPTION:
Kenworth trucks utilize two fuel tanks that are connected by a hose located at the bottom of the tanks for equalizing the tanks' fuel levels. The hose, called a crossover fuel line, represents a potential problem due to breakage from road debris. The design team had as its objective the relocating or eliminating of the crossover fuel line.

Bannan Auditorium
11:00 a.m.

PROJECT TITLE: The Design of Sigma-Delta A/D Converter
SPONSOR: **Boeing Aerospace and Electronics — Seattle, Washington**
LIAISON ENGINEER: **Bryan Buchanan**
FACULTY ADVISER: Prof. Margarita Takach
STUDENTS: Alexander Arceo, David Duenas, Karl Falk, Byron Scott

DESCRIPTION:
The objective of this project was to investigate, simulate and evaluate sigma-delta A/D converters. The A/D converter is a component of a demodulation system that might be used for Variable Differential Transformers. This system may provide an alternative to the one currently used by the Boeing Company.

PROJECT TITLE: Resistance Standard PCA and Enclosure for a Multi-Standard Calibrator
SPONSOR: **John Fluke Mfg. Co. — Everett, Washington**
LIAISON ENGINEER: **R. Michael Jamieson**
FACULTY ADVISER: Prof. Margarita Takach
STUDENTS: Melinda Chin, Daniel Galstad, Mike Kahler, Patrick Kennedy, Diogenes Oropesa, Jr.

DESCRIPTION:
The team designed an analog Printed Circuit Assembly (PCA) for the resistance standard and the enclosure for a multi-standard calibrator. This design is a cost effective alternative to the calibrator currently in use at John Fluke Mfg. Co. The design was aimed at reducing equipment costs and bulk, speeding calibration and increasing the range of standards used while maintaining standardized, easily interchangeable units.

PROJECT TITLE: Design of a Wireless Patient Connection for a Portable Defibrillator-Monitor
SPONSOR: **Physio-Control Corporation — Redmond, Washington**
LIAISON ENGINEERS: **Steve Firman and Gary DeBardi**
FACULTY ADVISER: Prof. Robert Heeren
STUDENTS: Cynthia Gimbel, David Horner, Pakuhn Sin, Anh Trinh

DESCRIPTION:
Present portable defibrillator-monitors are widely used to assess the cardiac condition of patients in emergency situations; these remain connected to patients during transport. The connection typically consists of two to four electrodes cabled to the portable defibrillator-monitor. Caregivers are moving around the patient, often in the confines of an ambulance, and the wires that attach the patient to the defibrillator-monitor can be accidentally pulled loose, stepped on and tripped over. This project designed an electronic means to replace the cabling with wireless transmission.

PROJECT TITLE: Analysis and Redesign of a Creepage Monitor for Bi-Metal Thermal Switches
SPONSOR: **Sundstrand Data Control, Inc. — Redmond, Washington**
LIAISON ENGINEERS: **Kevin Lauder and Chris Lewis**
FACULTY ADVISER: Prof. Robert Heeren
STUDENTS: Chris Erikson, Hoc Nguyen, Iswan Susanto, Edwin Valdez

DESCRIPTION:
Bi-metal switches are manufactured by the sponsor for use as thermal indicators and are in high demand by the aerospace industry. Manual one-at-a-time testing of these switches makes it difficult to ensure quality in mass production. A computer controlled circuit which simultaneously monitors the elapsed time of switching activation, or creep, of many switches under controlled temperature conditions was proposed by the sponsor. The design team analyzed, designed, and built this creepage monitor to agreed upon specifications.

Bannan Auditorium
1:15 p.m.

PROJECT TITLE: Design for Testability Module Development
SPONSOR: **Cascade Design Automation — Bellevue, Washington**
LIAISON ENGINEER: **Ray Farbarik**
FACULTY ADVISER: Prof. Francis Wang
STUDENTS: Ali Farhan Basit, Mike Clise, Tim Conners, Saoeum Oeurn, Andrew Troske

DESCRIPTION:
The team developed a set of modules to demonstrate sound Design For Testability (DFT) Techniques. Such DFT modules were then incorporated into an IC chip designed and laid out using the ChipCrafter CAE system. The chip was fabricated and tested using ATE equipment. Fault coverage was computed to illustrate the improvement of testability over a nontestable design. Four DFT modules were implemented. Documentation of how to use DFT modules and how to redesign chips using DFT techniques in the ChipCrafter environment were emphasized. Modules will be placed in ChipCrafter libraries for use by Cascade customers.

PROJECT TITLE: Design of a SONET OC-3 Overhead Byte Basic Indication Test Set
SPONSOR: **US WEST Communications — Seattle, Washington**
LIAISON ENGINEER: **Paul Beckett**
FACULTY ADVISER: Prof. Francis Wang
STUDENTS: Randy Caraway, Robert Hunt, Michael Lowe, Melvan Morris, Muljadi Tedja

DESCRIPTION:
A low priced test set capable of providing an indication of a Synchronous Optical Network (SONET) system's status was developed. The test set uses indicator lights for loss of signal, loss of frame, line alarm indication, and line far end receive failure. Commercially available IC chips were procured to perform the functions of optical to electrical signal conversions, signal conditioning, signal analysis, signal loss and power level indication. Logic circuits were designed to interface these chips and the LED indicators.

PROJECT TITLE: Heater Installation in Power Circuit Breakers
SPONSOR: **Puget Sound Power and Light Company — Bellevue, Washington**
LIAISON ENGINEER: **John Skog**
FACULTY ADVISER: Prof. H. Ward Silver
STUDENTS: Curtis Clute, Dan Kelly, Kar Ng, Joan Oishi

DESCRIPTION:
Simple heating elements are currently installed in substation circuit breaker enclosures to control breaker temperature. This design project improved control of temperature by integrating multiple sensors, heating elements, and air circulating devices with microprocessor control. The goal was to provide an even thermal environment inside the breaker cabinet and for the breaker itself.

PROJECT TITLE: JTAG Test Set for ASIC and AU4 Arithmetic Unit
SPONSOR: **Alliant Techsystems — Everett, Washington**
LIAISON ENGINEER: **Pat Kelly**
FACULTY ADVISER: Prof. H. Ward Silver
STUDENTS: Ted Burns, Neil McLean, Brian Tou, Tom Woods

DESCRIPTION:
The Arithmetic Unit is currently not compatible with existing JTAG test equipment. Furthermore, time on the in-house Teledyne ATE is expensive. The goal of this project was to perform JTAG test procedures on a portable, PC-based test set. The team designed a test interface and software to automate the test process with real-time feedback to the test engineer, and provided test documentation.

PROJECT TITLE: Design of an IEEE Single Precision Floating Point Square Root/Divide Module for ChipCrafter
SPONSOR: **Cascade Design Automation — Bellevue, Washington**
LIAISON ENGINEER: **Dave Johnson**
FACULTY ADVISER: Prof. Al Moser
STUDENTS: Dave Hagfors, Keith Lane, Tom Topinka, Rianisjah Wangadi

DESCRIPTION:
The design team evaluated a number of algorithms for calculating floating point division and square root. They then selected the most promising radix-4 or radix-8 divide unit using SRT and a square root algorithm, and utilizing the divide unit in an iterative fashion. The team implemented them as digital hardware in VLSI. The resulting module is a self-contained unit to be available as a library component for users of the ChipCrafter silicon compiler.

PROJECT TITLE: Data Acquisition Software for the U.S. Public Health Service's National Medical Database
SPONSOR: **U.S. Public Health Service — Seattle, Washington**
LIAISON ENGINEER: **Dr. Thomas Bonifield**
FACULTY ADVISER: Prof. Al Moser
STUDENTS: Osama Aldafea, Kris Bosland, Leah Jeanné, Tracy Oldfield

DESCRIPTION:
The team designed driver software for an interface between a PC running the POIS 2.0 database manager, an ECG monitor and a hand held computer. They also upgraded two drivers from POIS 1.0 to POIS 2.0 compatibility. They prepared a data transmission standard for two medical instruments and, finally, wrote an extensive application program in C for a hand held computer.

PROJECT TITLE: Transformer Modeling and Short Circuit Current Studies
SPONSOR: **Puget Sound Power and Light Company — Bellevue, Washington**
LIAISON ENGINEER: **Mike Sheehan**
FACULTY ADVISER: Prof. Xusheng Chen
STUDENTS: Kris Ducich, Diane Nguyen, James Ogle, Andy So, Shunfa Yang

DESCRIPTION:
The team developed a modification to Puget Power's in-house load flow analysis program such that, in the future, engineers can take substation transformers and their unique characteristics into account when projecting system effects arising from new service grids, possible fault conditions, etc. The work included entry of characteristics of over 900 transformers in Puget Power's system, writing of new code in FORTRAN to carry out load flow analysis on these devices, integration of this code into the main, already written, program, and implementation of a significantly improved user interface for this part of the program.

PROJECT TITLE: Graphics Project
SPONSOR: **Robert J. Kruse — Seattle, Washington**
LIAISON ENGINEER: **Robert J. Kruse**
FACULTY ADVISER: Prof. Bert Otten, SJ
STUDENTS: Gary Davis, Scott Hansen, Paul Penberthy, Bradley Snyder

DESCRIPTION:
This graphics project incorporated technology such as a desktop personal computer, modem and digital signal processor, together with engineered custom software to achieve the desired functionality. Challenging elements included data compression, protocol development and hardware integration using a high level programming language.

PROJECT TITLE: Fiber Optic System CAE Development
SPONSOR: **GTE Northwest, Inc. — Everett, Washington**
LIAISON ENGINEER: **Dave Phifer**
FACULTY ADVISER: Prof. Paul Neudorfer
STUDENTS: Zsolt Ari, Kah Wai Leung, Kevin Nguyen, Kim Nguyen, Terran Vigil

DESCRIPTION:
Telephone companies generally employ fiber optic links to route calls between central offices. Redundancy is built into the system and there are usually several pathways through which calls can be routed between distant locations. GTE Northwest desired that a data base describing the system be created and CAE software designed so that engineers can quickly identify optimum pathways under various conditions of system operation and failure.

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Sponsoring Organizations and Liaisons

We want to acknowledge with special thanks the organizations who sponsored engineering design projects in 1991-92, and especially the liaison engineers representing the sponsors, who worked with the students throughout the year. The time these liaison representatives spent in consultation with our design teams is much appreciated by the students and their faculty advisers. It is the liaisons who provide the history and background of each project, its relationship to other work in the sponsoring organization, and much of the technical direction that makes a project successful.

Alliant Techsystems	Pat Kelly
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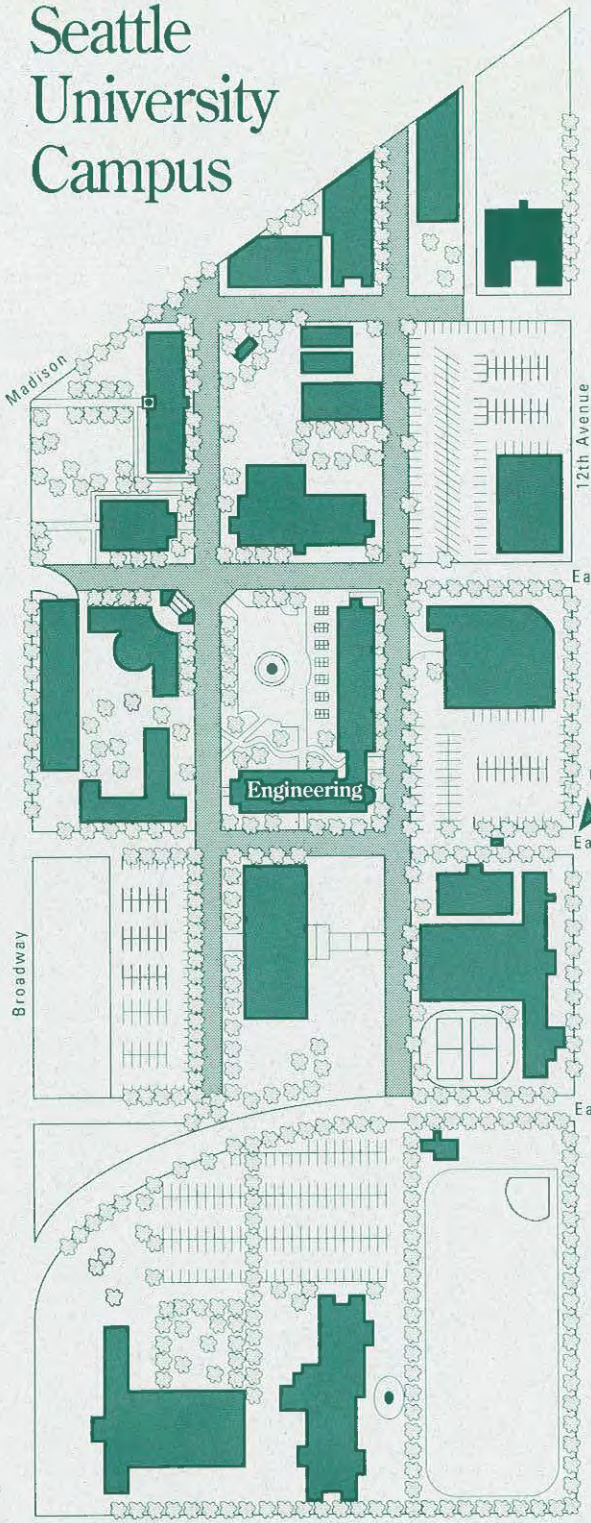

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