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CIVIL ENGINEERING (CIV)

(including WATER RESOURCES)

CIV 8101 **Genuino, Ernesto S. Jr. (MS Civil Eng'g.)**
Reduction in vehicle operating costs with the introduction of a Public Transit Central Terminal in the Central Business District of Manila.
1981.

This paper discusses the desirability of providing a public Transit Central Terminal (PTCT) in the Central Business District (CBD) of Manila, together with the attendant considerations in the establishment of such a complex facility. An attempt is also made to estimate the reduction of vehicle operating costs which can be anticipated as a direct benefit from the provision of the PTCT due to the removal of loading and unloading activities from the streets of the CBD, which activities will be transferred to the PTCT where they properly belong.

This calculation is based on traffic, travel time and delay data, and vehicle characteristics taken from the Metro Manila Traffic Engineering and Management (TEAM) Project of the Ministry of Public Highways (MPH) while data on the cost of congestion are taken from the Transportation and Traffic Engineering Handbook of the Institute of Traffic Engineers edited by Baerwald, Huber and Keefer which, in turn, are taken from a study by P.J. Claffey, Running Costs if Motor Vehicles as Affected by Road Design and Traffic. These congestion cost data are modified to reflect the vehicle composition and costs of fuel, tires and parts as applicable in the CBD.

The modification assumes that the rates of fuel consumption or tire of each type of vehicle during speed change operation. The tables in the handbook are supposed to consist of contributions or consumption shares from each type of vehicle on which composition they are based. The relative rates of consumption for each type of vehicle

during continuous or uniform operation are then used to determine the rates of consumption of each type of vehicle during slowdown-speed-up or stop-go operations in terms of the handbook's table values. The CBD vehicle composition and local costs are then applied to modify the handbook's set of congestion cost data.

With the expectation that congestion in the CBD can only get worse if nothing is done to keep it within an acceptable level, measures have to be taken to improve the CBD's accessibility and one of them is the establishment of a PTCT. It is admitted however, that a comprehensive feasibility study must be undertaken first to check on its overall advisability. The calculated reduction in vehicle operating costs due to the removal of loading and unloading activities from the streets of the CBD is a step in this direction and it is deemed substantial enough to merit a closer look at the PTCT's feasibility.

CIV 8302 **Bustos, Maximo T. (MS Civil Eng'g.)**
Reinforced earth structures.
1983.

This research has presented the following: a) literature for the technical study of the reinforced earth system, b) design procedures of reinforced earth's application to bridge abutment, and c) the method of determining the practical height of the reinforced earth mass for proportioning the reinforced earth bridge abutment.

The results of the study show that reinforced earth is a well-proven and properly investigated process. It has been already accepted worldwide and is now used as retaining walls and bridge abutments for highways, expressways and railroad lines, and other structures in industrial, civil, defense, and waterworks projects. Considering the different applications, it is therefore acknowledged that reinforced earth was a meritorious invention which has proved to be of considerable utility.

This new construction technique has advantages over existing methods. Reinforced Earth has five (5) main advantages:

Strength : The material can resist significant earth pressures and seismic forces.

Flexibility : The material can absorb large differential settlement, often enabling a wall to be constructed without filling in areas where it would be essential for reinforced concrete wall, i.e. adapts to sub-standard foundation soils.
Construction : A reinforced earth wall uses small prefabricated components, requires no formworks, and can be constructed by persons inexperienced in this type of construction, i.e. simple procedures and rapid rates.
Cost : Under ideal simple conditions, reinforced earth structure is generally cheaper than alternatives.
Aesthetic Factors : Architecturally, the many surface textures, shapes and colors developed for the panels and their joint patterns make walls of reinforced earth visually pleasing and allow them to be blended to the site.

The analysis, design, and behavior of the classical Vidal's reinforced earth wall is now quite well understood. Safe, economical reinforced earth structure now can be constructed. The adoption of this construction technique will provide the possible solution to some of our earth retaining problems. And this could be well applied to the construction of bridge abutment as well as retaining wall in the Philippines.

CIV 8303 **Muktabhant, Chinawat (MS Civil Eng'g.)**
Geotechnical investigation of soft clay for Bangkok airport.
1983.

The study presents the properties of the subsoil along the new runway of the Don Muang International Airport. The soil consists of a series of alluvial clays. The top soil is about 1 meter thick. Beneath it is a very soft clay which has a high compressibility. The computation of settlement has been made by using the summary of the subsoil properties from Krungthep Engineering Consultants Co. Ltd.

The improvement of the soil before the pavement construction has been determined by using sand drains and prefabricated drains. Estimation was made to compare the cost of the soil improvement with that without soil improvements but overlay the concrete on top of the pavement after 5 and 12 years.

CIV 8304 **Pacheco, Benito M. (MS Civil Eng'g.)**
An analysis of dam-foundation interaction under seismic loads.
1983.

Vibration analysis usually takes much computing space and time. Moreover, the nature of the interaction problem necessitates a manner of modeling more detailed than older ones, hence the handling and simultaneous processing of more data. Therefore a more efficient computing algorithm and its machine implementation are a key to a usable interaction model.

Even, excluding such refinements as generation of artificial strong ground motion record, and assembly of mass and stiffness matrices for arbitrary finite elements, much improvement may be achieved in the solution of the coupled equations of motion.

CIV 8305 **Sirisith, Chansak (MS Civil Eng'g.)**
Economical design of reinforced concrete beams in frame structures.
1983.

This thesis presents a computer program that will analyze and design general reinforced concrete frame structures economically by taking into account the cost of materials such as, concrete, steel and forms. The most economical design combination of the three parameters for a given frame will be determined.

The stiffness method is used for the analysis of the plane frame structure. The resulting joint displacements and member forces are used in the subsequent design process. The design approach is based on the requirements of ACl 318 - 77 (Building Code Requirements for Reinforced Concrete by American Concrete Institute). In the design, the computed member cross section, reinforcement, stirrup, formworks and material cost are automatically printed in tabulated form. The most economical and practical section is selected automatically. The study is applied to a variable span length frame to determine the effect of span length to the cost of the frame structure.

CIV 8306 **Tan, Richard C. (MS Civil Eng'g.)**
Engineering Properties of Manila Subsoil
1983.

The study consisted of the systematic collection of the available boring data, the investigation of patterns on subsoil formations, correlation and evaluation of the various engineering properties of the subsoil. It covered an area approximately 1.2 km. x 4.4 km. that included most or part of Intramuros, Binondo, Malate and Ermita. This area is called the "Manila Area" in this study.

Main geological features that have significant influence on the existing soil conditions were discussed. Similar to many other cities located in coastal or deltaic areas, the "Manila Area" is situated in an alluvial area that consists mainly of layers of sand, clay and silt, aggregating to depths that normally exceeds 30 meters or so.

CIV 8407 **Acupan, Antonio C. (MS Civil Eng'g.)**
Settlement analysis of two-layer cross-anisotropic media beneath a uniform strip load by finite element
1984.

An elasticity solution is presented for two-layer cross-anisotropic (transversely isotropic) media having a finite depth and loaded at the surface by a uniform strip load using the finite element method. The general solution was obtained for perfectly flexible and perfectly rigid structure. Numerical results were presented for cases of varying depth of the stiff upper layer and different degrees of anisotropy. The solution can also be reduced to the case of a single layer isotropic medium underlain by a rigid stratum and compared with the available results.

CIV 8408 **Chua, George S. (MS Civil Eng'g.)**
Non-prismatic serial frame analysis.
1984.

The purpose of this thesis is to provide a micro-computer program for the analysis of continuous non-prismatic frame.

Member carry-over coefficients and stiffness constants are computed using the flexibility method; solution of the set of simultaneous equations is done by the modified Cholesky method for banded symmetric matrices; member end-moments are obtained by the use of the slope-deflection equation.

Capabilities and limitations of this thesis:

1. A maximum of sixty (60) continuous spans.
2. A maximum of twenty-four (24) changes in section per member.
3. No limit to the number of loading cases as well as to the number of loads per span.
4. Capable of handling uniform loads, triangular loads, or trapezoidal loads on full span or trapezoidal loads on full span or an partial span; and also concentrated loads.

CIV 8409 **Gutierrez, Marte S. (MS Civil Eng'g.)**
Finite Element Analysis of the dynamic response of Planar Coupled Shear Walls.
1984.

The finite element method was used to analyze the dynamic characteristics and seismic response of planar coupled shear walls. The conventional 8-d.o.f. plane stress rectangular finite element with linear edge displacement and a lumped mass formulation was used.

Two coupled shear wall problems were solved. The first is for the analysis of root convergence of the finite element formulation while the second is an application to a coupled shear wall building. A computer program was developed to solve the eigenvalue problem using the subspace

iteration technique. Seismic response analysis was made using the response spectrum technique and the 1940 El Centro earthquake as input.

Results were compared with the continuum method and Uniform Building Code provisions. The comparisons show significant differences in the results.

CIV 8410 **Maneepai, Satit (MS Civil Eng'g.)**
The finite element method solution for the right cylindrical tank with nonuniform wall thickness.
1984.

A need exists for the development of the Axis-symmetric Stress Analysis (two-dimensional element) that can be used for static analysis of stress distribution in the bodies of Axis-symmetric solid structures under Axis-symmetric loading. Such two-dimensional elements are required if it is desired to analyze the right cylindrical tank with linear non-uniform wall thickness under the internal pressure. In this thesis the stiffness matrix for the right cylindrical shell element is derived using the shell theory and cylindrical coordinate system.

The stiffness matrix of two-dimensional element can be generated using standard procedures based on the direct stiffness matrix. The assumed displacement functions are all dependent on the values of the shape functions which are obtained from the linear relationship specifically for two-dimensional quadrilateral shape or elements. These displacement functions are accomplished using interpolation procedure. The examples were solved using the FORTRAN IV programming HP/3000 computer and the solution was found to compare favorably with solution obtained by different finite element meshes.

CIV 8411 **San Pedro, Ernesto K. (MS Civil Eng'g.)**
Nonlinear dynamic response of building frames.
1984.

The nonlinear dynamic response of an existing three storey building frame to strong motion earthquakes are

found. Idealized elasto-plastic moment rotation relationships are assumed for every member end. Elasto-plastic analysis is achieved by the step-by-step numerical integration of the differential equations of motion. Other assumptions and simplifications are introduced in order to keep the computation time within reasonable limits.

Results are presented in the form of response curves and compared with the static analysis of the frame using Code prescribed seismic loadings.

CIV 8412 **Yu, Antonio T. (MS Civil Eng'g.)**
The effects of static indeterminacy and I correlations on the reliability of structural systems.
1984.

The effects of degree of static indeterminacy and strength correlations on the reliability of statically indeterminate structures is studied using Monte Carlo simulation.

The statically indeterminate structure is modelled by a simple, ductile link structure with varying member population. The degree of static indeterminacy is represented in the model by the number of redundant members. The model is subjected to a deterministic load, and the member resistances - which are assumed to be random variables following a multivariate normal distribution - are generated using Monte Carlo techniques. A simple redistribution scheme is assumed whenever the stress in any member reaches yield point. Failure is defined as the yielding of all members.

To test the validity of the study's findings to more realistic, conventionally-designed structures, the reliability of a simple rectangular frame with multiple loads and failure modes as well as varying degrees of static indeterminacy is evaluated using a plastic collapse formulation.

For structures characterized by having one dominant mode of failure (i.e., a failure mode with much higher probability of failure than the other failure modes), the following conclusions are drawn:

1. The degree of redundancy has a considerable effect on a structure's reliability. Increasing

the degree of static indeterminacy can significantly lower the probability of failure.

2. The effect is particularly pronounced at low failure probabilities and a low correlation coefficients.
3. When the degree of redudancy is low (i.e., from 1 to 4), the probability of failure is very sensitive to redudancy. This sensitivity, however, rapidly diminishes as the degree of redudancy increases.
4. The probability of failure decreases at decreasing correlation coefficients.
5. For failure probabilities of less than 10^{-3}, and correlation coefficients of less than 0.75, the presence of at least one redundant member can lower system failure probabilities by at least 30%. For correlation coefficients of less than 0.50, the probability of failure is decreased by more than 60%. At zero correlation, the probability of failure is reduced by as much as 90%.

For structures with one dominant failure mode, it is the degree of redudancy of that mode, rather than the structure's overall degree of static indeterminacy, which determines the reliability of the structure. For structures which do not have a dominant mode of failure, but which involves several failure modes, the above conclusions may not necessarily apply, as the beneficial effects of redundancy may be offset by the weakest-link characteristics of the structure.

CIV 8513 **Iglesia, Geraldo R. (MS Civil Eng'g.)**
Two-dimensional elastostatic continuum analysis by a boundary element technique.
1985.

An attempt is made to improve on the numerical implementation of the boundary element technique as applied to linear elastostatic analysis of plane strain and plane stress problems. The formulation and discretization of the integral equations on which the boundary element method is based are then presented. Three independent computer

programs for different types of boundary elements with respect to geometry and function interpolation are developed, i several salient aspects of previous works. The close agreement between the results obtained via these programs and the analytical solutions attests to the capabilities of the boundary element method as a useful supplement or, in some cases, a plausible alternative to existing solutions for various elastostatic problems.

CIV 8514 **Lim, Peter S. (MS Civil Eng'g.)**
A study of the mechanical properties of glass reinforced plastics (fiberglass).
1985.

On the basis of the test data obtained and derived from the different actual tests conducted on several specimens of Glass Reinforced Plastics, the following conclusion are drawn.

The tensile and compressive capacities of GRP largely depend upon their constituents as well as their weight proportion. The constituents, which comprise the substance of the material, refers to a large corresponding amount of resin mix.

The orientation of the reinforcing fibers and their length greatly influence the structural capacity of the material. Composites made up of chopped strand are generally inferior as compared to composites made from woven roving by reason of orientation and fiber length.

GRP composites obey Hooke's Law with relatively small deviations, reflecting the major influence of the glass fiber constituent.

It is noteworthy to add that in the course of the experimental tests conducted in the laboratory, certain source of errors have been detected that could have contributed to some extent to the inaccuracy of the test results.

On account of human shortcomings as evident in the preparation and fabrication of the GRP test specimens used in the experiment, the non-homogeneity of the material, the non-uniformity of the fibers in terms of length, arrangement and layering. Some portion of the specimen showed

incomplete lamination caused by air bubbles, resulting in a defect in the composite's fabrication.

In shaping the specimen to the required shape or dimension, some strands were cut thus reducing the length of the fiber which in turn affects the strength of the composites.

It cannot be discounted that the equipment used were not so reliable as to render accurate results. An example would be in the case of the tension test, where grip tended to slip time after time. In compression, tilting of the plate was very evident. Although three dial gages were used, averaging the three readings still did not probably give the accurate deflection for the given loading.

In flexural test, due to the limitation in the space for the apparatus to register the actual deflection was measured through the rigid steel frame supporting the test apparatus. The deflections presented are deflection where the effect of the steel frame deflections were assumed to be negligible.

CIV 8515 **Medina, Enrique C. (MS Civil Eng'g.)**
Rectangular hybrid element applied to shear wall analysis.
1985.

This thesis is about a new type of rectangular element applied in the static analysis of shear wall-frame structure. This element is a hybrid element but with rotational degree of freedom added at its corners. This degree of freedom simplifies the discretization of the structure into finite element meshes and the computer program when either or both beams and columns connected to shear walls are encountered. All the matrices required for the generation of the stiffness and stress matrices of this element were derived in detail. Early type of elements used for the same purpose were also discussed and a computer program was written that can analyze structures that uses either or both line element and this element for its representation.

CIV 8516 **Sybico, Jesus Jr. A. (MS Civil Eng'g.)**
Analysis of frames with semi-rigid connections.
1985.

The Increment Load Procedure (multi-linear model) or ILP is a more realistic behavior approximation of the moment-rotation curve of semi-rigid connections than the linear method.

Basing on the failure relative rotation values published by Rathbun (1936), the ILP is off by 5% to 20% for the various type 1 connections used in the example whereas the linear method is off by 59% to 72%. In the case of type 2 connections, the ILP is off by 12% to 28% and the linear methods is off by 17% to 38%. When dealing with frames with type 1 semi-rigid connections, there are significant differences in output results between the ILP and rigid analysis to justify semi-rigid analysis.

The average decrease in member stress (P/A + My/I) when using the ILP is 21% under gravity loads. Under combined gravity and lateral loads, the average decrease is 11%. Finally, the comparison of design forces shows an average decrease of 13%. With type 2 semi-rigid connections, there are also significant differences in output results between the ILP and conventional analysis.

Under the gravity load condition, there is a 38% general increase in member forces. Under the gravity and lateral load condition, however, the results show no definite advantage of one analysis over the other. The dominance of the gravity load criteria on the design forces discourages the use of type 2 connections and semi-rigid analysis. This is evident in the 6% general increase shown. With type 1 connections, the use of the ILP (semi-rigid analysis) over rigid analysis increases horizontal joint displacements by 91%, and rotational joint displacements by 274%. There are, however, no substantial difference in vertical displacements. With type 2 connections, the use of the ILP (semi-rigid analysis) over conventional analysis decreases horizontal joint displacements by 9% and rotational joint rotations by 11%. Like type 1 connections, there are no substantial differences in vertical displacements.

CIV 8517 **Reyes, Olivia Maria L. (MS Civil Eng'g.)**
The development of a geotechnical information system for micro-computers (GeoBASE).
1985.

A method of organizing a database of exploratory boring records is presented in this study. For the purpose of storing and accessing data in the geotechnical database, a set of menu-driven application programs, named "GeoBASE", has been developed using the dBASE II database management system software. "GeoBASE" and the database files together comprise the geotechnical information system for micro-computer.

CIV 8618 **Bautista, Leoncio Q. (MS Civil Eng'g.)**
Unified nonlinear analysis of reinforced and partially or fully prestressed concrete sections.
1986.

This paper attempts to predict the inelastic behavior of reinforced and partially or fully prestressed concrete sections. The theoretical basis of the nonlinear analysis procedure and determination of moments, curvatures and deflections are discussed. The computer program generated which could analyze rectangular, I or T section yields the location of neutral axis, bending moment, curvature and deflection at different stages of loading. The results of the computer test samples show the influence on the inelastic behavior of concrete sections of major variables such as the reinforcement indices, effective prestress, and stress-strain relationships for concrete and steel. Particular emphasis is put also on the agreement between the ultimate moments obtained using the approximate analysis procedure suggested by the ACI Code and nonlinear analysis presented. It is concluded that the total reinforcement index affects greatly the behavior of structural concrete section; that is, as it increases, the flexural strength increases but deformation ability drastically decreases. It is also suggested that in cases where seismic loadings are considerable the beams should be under-reinforced and partially-prestressed in order to have large capacity of flexural members to absorb the energy of impact.

CIV 8619 **Villaseñor, Vinci Nicholas R. (MS Civil Eng'g.)**
Mean recurrence interval as a criterion for the termination of design wind load on structures in Metro-Manila Area.
1986.

The thesis presents some probabilistic methods of determining the basic design wind load as an alternative to the current deterministic wind speed of 175 Kph for the Metro-Manila area as specified by the National Structural Code for Building (NSCD). Other engineering codes have recognized the need to specify wind loading based on the probabilistic concepts consistent and adequate levels of safety. The mean recurrence interval as the design criterion for the determination of wind loading is proposed in keeping with the continuously improving standards of other engineering codes.

The basic design wind speed specification of the NSCD is discussed. Model parameters of the Gumbel and Frecket distributions (Type I and Type II distributions of the largest values respectively) are estimated using annual maximum wind speed data obtained from the three weather stations of the Philippine Atmospheric Geophysical, and Astronomical Services Administration (PAGASA) in Metro-Manila. Two sets of parameter values are determined for the Gumbel distribution; the parameters derived by the Lieblein fitting technique and the parameter derived by the method of moments. The Kolmogorov-Smirnov goodness-of-fit test is used to determine the acceptability of the probabilistic models and the Gumbel distribution (Type II distribution of the largest value) is found to best model annual maximum winds in Metro-Manila. The basic design wind speeds corresponding to suggested values of mean recurrence intervals are computed based on the probabilistic model chosen.

CIV 8720 **Adan, Edwin C. (MS Civil Eng'g.)**
The coupling of the boundary solution procedures and the finite element methods; Applications in two-dimensional elastostatic.
1987.

This study is an attempt to show how the coupling of the boundary solution procedure and the finite element

method can be used to solved two-dimensional elastostatic problems.

The concepts of the finite element method and the boundary solution procedures are first presented. Next, the coupling of the procedures and the discretization of the boundary integral equations, which is the starting point in formulating a new boundary type element are then presented in detail.

A suite of four computer programs are developed for this purpose. The results obtained using these programs attest to the capabilities of the coupling of the boundary solution procedure and finite element method.

CIV 8721 **Aristorenas, George V. (MS Civil Eng'g.)**
Plasticity constitutive routines for finite element analysis.
1987.

The classical elasto-static finite element analysis assumes that the continuum adopts a linear elastic response, regardless of the magnitude of the applied loads or deformations. This assumption is valid for materials tested to behave elastically under normal service load conditions. This is no longer true in failure or fracture analysis since, at these conditions, the material would have exhibited some form of non-linearity in its response. In fact for some materials such as concrete and soil, a non-linear response may be encountered even during the early stages of loading. For such cases, a non-linear analytical tool is needed. This thesis, therefore, presents plastically constitutive routines that can be integrated in a finite element program.

The constitutive routines use the Tresca and Von Mises yield functions, two criteria experimentally verified to be valid for metals. Formulation is based upon an associated flow rule where the yield function is also the plastic potential at the same time.

The routines are used to analyze three problems: uniaxial compression of both an unconstrained and constrained cylindrical specimen, and a thick-walled cylinder subjected to internal pressure.

Program listing of the plasticity constitutive routines are also provided.

CIV 8722 **Dizon, Cornelio Q. (MS Water Resources)**
ARMA modelling and forecasting of monthly streamflows : with application to the Angat reservoir inflows. 1987.

A step-by-step procedure of ARMA model construction is presented and used to model and forecast the monthly inflows to the Angat Reservoir. Statistical properties (mean, standard deviation, correlation coefficient, standard forecast error, and peak forecast error) on the one-step-ahead forecast for the various competing ARMA models are computed in order to compare their actual performance and to check if their forecast preserved the statistical properties of the historical data.

CIV 8723 **Espino, Armando Jr. N. (MS Water Resources)**
A study on the relationship between drainage basin's geomorphic parameters and streamflow characteristics. 1987.

Developing better methods in prediction and estimation of runoff process has been the subject of researches of hydrologists and planners for annual maximum daily streamflow. The thesis aims to establish a prediction model by investigating the relationship between geomorphic parameters and runoff process using regression and correlation analysis.

With some established criterion, the drainage network of seventeen watershed in the Bicol Region and the Island of Catanduanes were analyzed. The watershed area, streamcount, streamlength, main channel length, and topographic factor of each watershed were measured and quantified. The precipitation volume for each sample watershed was also derived using the Thiessen polygon method. To estimate the magnitudes of annual maximum daily streamflow for design periods 2, 5, 10, 15, 20, and 25 years, the collected streamflow data of each watershed were subjected to frequency distribution selecting the best fitting probability distribution.

Regression is concerned with the ability to build a statistical model which was a set of independent or

predictor variables in order to estimate the expected value of some dependent variables. Here, the event magnitudes of streamflow were taken as the dependent variables. The geomorphic parameters of the watershed and the precipitation volume received by each watershed and the areal extent of forest cover were considered as the independent variables or predictor variables.

Using the stepwise regression analysis, it was revealed that the existence of stream channel, their numbers and lengths which are indeces of the capacity of the drainage basin to transmit water effectively have a consistent significant relationship with maximum flows.

CIV 8724 **Irinco, Reinerio E. (MS Water Resources)**
A drainage study of the south-west portion of the upper Pampanga river integrated irrigation system. 1987.

The drainage problem of the south-west portion of the Pampanga River Integrated Irrigation System (UPRIIS) in Nueva Ecija was evaluated both at the ground surface and sub-surface. A 9,456 hectare-area was chosen for this study based on the availability of daily measured groundwater table depths from March 15 to August 23, 1983.

Surface drainage was analyzed by presenting a surface hydrologic water balance of the study area using average monthly rainfall and evaporation data. The surface drainage discharge capacity was relatively low (5.5 millimeters per day).

Various components of groundwater flow which contributed to or caused the drainage problem were evaluated using appropriate water balance equations.

The net lateral groundwater inflow was relatively very slow, sometimes zero flow exists. This slow groundwater movement was due to several factors, one of them is the presence of slow receding San Antonio Swamp. Although the swamp was outside the study area, it is located at the confluence of Pampanga and Rio Chico Rivers which serve as the main drainage outlet of the study area.

The net vertical groundwater recharge sometimes indicated negative sign. This could be due to the occurrences of shallow water table depths.

A mathematical groundwater model was developed for the study area which was considered to be unconfined aquifer. The model's numerical solution was obtained using finite difference method and numerical solution utilized Gauss-Seidel iteration algorithm. Model's calibration was made by comparing the computed and measured water table elevation as to their goodness of fit, a method commonly known as "history matching".

The model could be used to simulate various groundwater development plans for the study area.

The results from this study showed that there was excess water both at the ground surface and sub-surface especially during wet season. Drainage was necessary in order to increase further agricultural production in the study area.

If water table depths have to be controlled at an elevation one meter from the ground surface, the sub-surface drainage discharge capacity would seem to be relatively high due to shallow water table depths. For nodal area 6, the discharge capacity was 170 millimeters per day.

Drainage of the study area was possible by providing adequate drainage outlets and improving the existing drainage channels. Another worth considering was drainage by pumping.

CIV 8725 **Lopez, Patricia L. (MS Water Resources)**
Optimization of operation of the Mindanao power systems.
1987.

Basically, the Mindanao power system is a water resource system because it is dominated by hydro plants. The operation of the reservoirs of these plants, determines the ability of the grid to deliver the energy required by its consumers at a cost that is efficient to its owner, in this case, the government. In other words system operation is equated to the management of these reservoirs. The effectivity of management is reflected in the absence of power failures resulting from low inflow and depleted reservoirs. Since inflow is an unknown quantity in the reservoirs management, there is a need to plan for the reservoir releases which will affect the operation of the system.

This work is a first step towards the development of a real time optimization model of the Mindanao System and thus

is centered on a long/middle term optimization analysis.

The long/middle optimization model developed, utilized an operations research method called the Dynamic Programming Successive Approximation (DPSA) technique. The objective function is the use of the water from the reservoirs of the existing hydro plants to satisfy energy system requirements with the view to minimizing operating system cost through the minimum usage of the standby diesel plants over a 52-week or one year period. The reliability criteria is expressed in monetary terms as Penalty if the reservoir is not able to meet and level targets. The result of the optimization process is an optimum policy - a schedule of releases with their corresponding reservoir levels which could serve as targets for future work on short term optimization. The study of the results will also provide an insight on system needs. The optimum policy is tested for reliability using a simulation software program (HEC-3), already available in NAPOCOR.

To test the model evolved, optimization was made here of the Mindanao Power System using the available historical inflow data converted into weekly series. Three typical hydrological conditions (dry, average, wet) were used to test the behavior of the model developed. The analysis was made at a future year (1995) and assumed the 1985 Mindanao Generation Expansion Plans to be in effect. The results of the analysis established generally that the optimization of the Mindanao system on a long/middle term could be done by the DPSA method. This is inadequate in terms of meeting future demand. This is evidenced by the non-recovery of the optimum trajectories of the reservoirs whatever hydrological condition was used. The results of the simulation by HEC using a 55-year historical series had also confirmed these conclusions. The optimization established the fact that Agus I is the most important reservoir to be optimized, with the other reservoirs not registering definite patterns of releases, implying these reservoirs to be good only for short term regulation.

CIV 8726 **Manlangit, Vicente Jr. B. (MS Civil Eng'g.)**
A Comparative study of the SEAOC lateral load recommendations & elastic dynamic analysis.
1987.

The motion of multistory buildings due to dynamic excitation is idealized in simple form as a multi-degree of

freedom lumped masses and elastic springs model. In this idealization, it is assumed that the columns supporting and interconnecting the floor systems are massless and the entire mass of the structure is concentrated at the floor levels; the floor systems and beams are rigid in the vertical direction. The structure is assumed to be supported on rigid ground. Thus, forces and displacements associated with each horizontal component of ground motion are separately determined with one lateral degree of freedom per floor in the direction of the ground motion being considered. Such analysis may be carried out by either the Modal Analysis Procedure or a simpler method that will be referred to as the Equivalent Lateral Force Procedure. Both procedures lead directly to the lateral forces in the direction for the ground motion component being considered. The main difference between the two procedures lies in the magnitude and distribution of the lateral forces over the height of the building. In the model analysis procedure the lateral forces are based on the properties of the natural vibration modes of the building, which are determined from the distribution of mass and stiffness over height. In the lateral force or rather in the equivalent lateral force procedure the magnitude of forces is based on an estimate of the fundamental period and on the distribution of forces as given by simple formulas appropriate for regular buildings. Otherwise the two procedures have similar capabilities and are subject to the same limitations.

The direct results from either procedure permit one to ascertain the effects of the lateral forces in the direction under consideration : story shears, floor deflections, and story moments.

CIV 8727 **Rojas, David Jr. S. (MS Water Resources)**
Seasonal ARMA modeling and forecasting of average 5-day streamflows : with application to the Angat reservoir inflows.
1987.

A seasonal forecasting model for the average five-day inflows of the Angat reservoir is developed using the ARMA (autoregressive - moving average) modeling methodology for stationary time series. In developing the model, three

assumptions are made, namely : (a) the periodicity of the time series is monthly wherefore the number of seasons in a year is twelve; (b) each month is composed of six average five-day inflows; and (c) the parameters of the model of each month can be obtained independently from the other months. The best-fit models for the independent monthly series are arrived at by following the ARMA modelling procedure and the maximum likelihood parameter estimates if these models are taken as the periodic parameters of the seasonal forecasting model. The forecasting model is evaluated by comparing the generated lead-one forecasted inflows to the observed data from January 1969 to January 1986. The forecasts are found to closely approximate the measured low inflows and the recession limbs of moderate floods. On the other hand, the forecasts generally underestimate the observed peak flows and the recession limbs of extremely high floods.

CIV 8728 **Samson, Ramon V. (MS Civil Eng'g.)**
Matrix stiffness method turbo Pascal program and modules for framed structures.
1987.

The execution of structural analysis by hand for other than small structures is essentially impractical, now that computer facilities and computer programs with various degrees of completeness and reliability, are available from a variety of sources. For structures which can be idealized as an assemblage of line elements, the matrix stiffness method of structural analysis lends itself to straight forward computer applications.

The intention of this thesis is two-fold: first, to provide a fully-interactive, documented software for the linear analysis of elastic, statically-loaded framed structure, for general use in engineering practice. Second, to design this software using a "building block" approach to provide the engineers or the engineering student with program modules which he can use to assemble his own computer programs to solve his own particular engineering problems.

The matrix structural analysis (MSA) program as developed, is written specifically for use on the IBM PC/XT/AT and its compatibles. It utilizes the stiffness

method to solve plane truss, plane frame, grillage, space truss, and space frame. Features of the program include ease of input and checking, graphics capability for displaying the geometry of the input structure, file management to store and retrieve input data, and printouts for input and output data. Input consists of the geometry of the structure, loads and material properties. Output options include joint displacements, member and forces, member stiffness matrix, global structure matrix and load vector.

CIV 8729 **Suharjanto (MS Civil Eng'g.)**
Analysis of single plane cable-stayed bridge towers. 1987.

Curves of buckling load in transversal and longitudinal direction indicate the end-points condition of the tower structure. In transversal direction, the tower behaves as a fixed free end column; while in the longitudinal direction, where there is an effect of elastic strength of the cables at the top of the tower as the height of the tower is gradually increased the curve approaches the fixed-free end condition. On the other hand, if the height of the tower is gradually decreased the curve approaches the fixed-hinged end condition.

The behavior can be explained as follows: When the height of tower increases, the slope of the cables against horizontal displacement becomes weaker, which represents the incremental stiffness at the cable attachment. The stiffness coefficient due to elastic stretch of the cable is proportional to sine of the angle between cable and tower). This means this stiffness coefficient is inversely proportional to the slope of cable. If the height of tower continuously increases, it will reach a condition in which this effect can be neglected and the tower will behave like a fixed-free end column. When the height of the tower is gradually decreased, the slope of cables also decrease. This will cause the restraint by the cables to become stronger. And finally, it will reach such condition where the restraint is very strong such that it will behave ar rigid support (simple support). In this condition on the tower will behave as fixed-hinged end column.

The similar behavior as a radiating system also applies to the harp system. In this case, because of the effect of elastic stretch of the cables which is distributed throughout the height of the tower, the curves become flatter than radiating system.

Curves of buckling in longitudinal and transverse direction indicate that using the harp system is safer against buckling than the radiating system. For the purpose efficient design of the section of the tower against buckling, the section will be designed such that the buckling load in the two principal axes have the same value. The parameters investigated for these configuration is the ratio of moment of inertia of the two principal axes. According to the code of cable-stayed bridge, due to economic and construction reasons, the ratio between the height of tower and the maximum span of the girder is limited between 1/6 and 1/2.5. Thus the recommended ratio of moments of inertia for practical design is between 1.6 to 2.0.

CIV 8730 **Villa, Rhoel C. (MS Water Resources)**
State estimation techniques for monthly streamflow forecasting with application to the Angat reservoir.
1987.

The research study illustrates the use of state estimation techniques for monthly streamflow forecasting. Time series models of the ARMA and ARMAX types are cast within the state-space framework of the Kalman filter and used to forecast the one-month ahead inflow at the Angat Reservoir. The forecasts are of two types, pure state estimation and combined state-parameter estimation. The former assumes that the model parameters are time invariant while the converse is assumed in the latter. The performance of the identified forecasting models are compared and evaluated through the use of the mean, standard deviation, correlation coefficients, standard forecast error and mean peak forecast error of the forecasted series. The model selected for the systems dynamics to be used within the Kalman filter framework is a combination of the AR(1) and AR(3) models.

CIV 8731 **Widodo (MS Civil Eng'g.)**
A Comparison of equivalent static (Indonesian Code) and dynamic analysis on multistorey reinforced building frames.
1987.

This study attempts to investigate the application of the dynamic analysis method in multi-storey reinforced concrete buildings using different sets of applied earthquake ground accelerations and then, to compare the results with the Indonesian Building Code provision. Particularly the study seeks to determine the floor lateral forces of multi-storey buildings for different earthquake ground acceleration. The study is limited to the elastic response and the maximum floor to floor horizontal displacement allowed by the Indonesian Building Code.

Modal analysis or modal superposition method is used in reducing the multi-degree of freedom system to a set of single-degree of freedom system of equations. For numerical integration, the constant velocity method is used. Available earthquake records are utilized to provide the forcing function.

CIV 8732 **Zarco, Mark Albert H. (MS Civil Eng'g.)**
Elastostatic analysis of underground openings by boundary element method.
1987.

This study attempts to present a boundary element method based on the general displacement discontinuity problem for elastostatic analysis of underground openings. The fundamental solution adopted considers an elastic half-plane. The formulation of the numerical method is discused.

The boundary element method developed is implemented in a computer program called Boundary Element Analysis System (BEASY). The program has the capacity to analyze two-dimensional elastostatic problems involving finite, infinite as well as half-plane domains. The method of images is used to incorporate symmetry conditions. Effects due to gravity are treated as initial stress fields.

Accuracy is increased by using analytically integrated elements.

Illustrative examples, representing problems frequently encountered, are presented. These include circular, horseshoe and double circular excavations as well as circular excavation in sloping ground. A comparison is made between the half-plane and infinite plane solution. Finally effects of the depth of excavation on the convergence of the stresses to the initial stress field are examined.

CIV 8833 **Blanco, Jose Misael B. (MS Water Resources)**
State estimation techniques for five-day streamflow forecasting with application to the Angat reservoir.
1988.

State-space techniques and Kalman filtering are applied to the class of autoregressive moving average (ARMA) models for the purpose of real-time forecasting of 5-day inflows to the Angat reservoir. Unknown noise statistics are estimated using an adaptive recursive estimation algorithm. Forecasts are obtained using both state estimation and combined state-parameter estimation techniques. Combined state-parameter estimation allows the model parameters to be recursively updated and is an attempt to simulate the effects of increasing record length. The use of the multivariate ARMAX model (ARMA model with exogenous input) to take explicity into account the effect of rainfall on the runoff process is also considered. Model performance is evaluated by comparing important statistical properties of the observed and forecasted data.

CIV 8834 **Germar, Fernando J. (MS Civil Eng'g.)**
Earthquake simulation program using sinusoidal superposition method.
1988.

A program for synthesizing artificial accelerograms using power spectral density and time varying root mean

square value function as input. Programs for analyzing earthquake records for its autocorrelation, power spectral density, time varying root mean square function, and response spectrum as well as utility programs for creating, updating, listing, and graphing files created by the different programs are likewise included.

CIV 8835 **Mundo, David P. (MS Civil Eng'g.)**
strength and behavior of lightly reinforced concrete beams with lattice girder reinforcement.
1988.

Tests of three lightly reinforced full-scale beam models were carried out to comparatively study the strength and behavior of a concrete beam reinforced with a lattice girder with the ordinary reinforced one. In order to solve this problem, a conventionally reinforced concrete beam without stirrups, a concrete beam reinforced with two-dimensional lattice girder and a concrete beam reinforced with three-dimensional lattice girder were tested until failure. Results indicate that there was a significant increase in capacity for the concrete beam that was reinforced with a lattice girder with no loss of ductility. After studying the crack patterns and the measured strains of the lattices, it was found that the cause of additional strength provided by the lattice girder in comparison with the ordinary reinforced concrete one was due to the tensile force resisted by these diagonal members that were welded to the chords after being crossed by cracks.

The theoretical predictions based on the ordinary reinforced concrete beam theory gave good agreement with the experimental values for the ordinarily reinforced concrete beam but low calculated results in comparison with the experimental values were obtained for the beams with diagonal lattice members. Evaluation of the strength contribution of the diagonal lattice members in the region of pure moment for beams with lattice girder reinforcement has been identified.

CIV 8836 **Nwankwo, Felix O. (MS Civil Eng'g.)**
Earthquake response analysis of horizontally layered Manila soils.
1988.

The aim of these study is to provide the response spectra of Manila soils due to a given Earthquake force (PASADENA and El CENTRO N.E.). The response spectra of the three Manila sites will be combined to generate a design spectrum for the Manila soils. The reason for using PASADENA and EL CENTRO, N.E. earthquakes are available. This study is intended to serve as a guide to the foundation design of Manila soils. Used in this study is a computer program called SHAKE, developed at the University of California, Berkeley. This study includes an investigation into the dynamic properties of soils and the variables that affects the dynamic response.

CIV 8837 **Nwokoye, Peter O. (MS Water Resources)**
Evaluation of water yield and rainfall-runoff relationship of a secondary dipterocarp forest watershed.
1988.

A computer program called Surface-storage Infiltration and baseflow model was used for water balance evaluation in a secondary dipterocarp forest that converse an area of 4.59 ha in the Angat watersheds. The study aimed to evaluate the water yield based on three parameters namely: rainfall, evaporation and streamflow. When the parameters are set for various land use classifications, good estimates are readily achieved. This three-parameters water balance model can be used to estimate water yield from ungauged catchments using daily rainfalls and evaporation data. For the period under study, the data used was divided into two parts: one half was used for model calibration and the other validation.

Coefficient of runoff was observe to range from 0.19 to 69.73. There is a need to test the model in other climatic type other than type 1 climate and also for bigger watersheds in order to evaluate its accuracy. Its use as a tool for further hydrologic studies seems appropriate. More

studies using the model to investigate the effects of change in the watershed such as urbanization and agricultural land use changes are recommended.

CIV 8838 **Pasco, Agnes M. (MS Civil Eng'g.)**
A study on the structural performance of coconut timber and truss-framed system: New alternatives for low-cost housing construction.
1988.

The purpose of this research is to study the structural performance of coconut lumber as a truss frame, alternative material and method combining the attractive features of prefabricated light-frame construction and low cost building material substitute.

Results of the analysis of the model frame, a basis for the design of other truss configurations, indicate satisfactory performance of coconut lumber truss frames in the structural engineering point of view.

CIV 8839 **Pugne, Jen S. (MS Civil Eng'g.)**
A Computer program for the analysis of bending of rectangular plates with or without opening and with various support conditions.
1988.

This thesis is an effort to furnish a computer program for the analysis of plates by finite element method. The plates analyzed by this computer program are:

a) Bending of rectangular flat plates.

b) Plates with or without opening which may vary in size and location but rectangular in shape.

c) Plates with elastic supports at their corners along their edges and/or over their entire area (elastic foundation).

d) Plates with Uniform load per unit area acting perpendicular to their surface, and/or uniform load (perpendicular or rotational) per unit length along their edges.

CIV 8940 **Lejano, Bernardo A. (MS Civil Eng'g.)**
Finite element method and experimental investigation of the dynamic characteristics of vertical cylindrical shell.
1989.

A finite element program based on Mindlin's shell plate theory was used to determine the dynamic characteristics of vertical cylindrical shell with a fixed base. One dimensional elements were used to discretize the longitudinal section and Fourier expansion was used to define the circumferential behavior of the cylinder. Convergence was improved by using higher order elements and reduced integration technique. The effect of ratio of height to radius (H/r) and ratio of thickness to radius (T/r) were investigated and found significant. The effect of Poisson's ratio was also investigated but showed very little influence.

Experimental investigation of the dynamic characteristics was performed using a cylindrical shell model made of rubber. Forced vibration tests were conducted using a shaking table while free vibration test was accomplished by applying an initial displacement. The results indicate good agreement between the experimentally and numerically obtained dynamic characteristics.

CIV 8941 **Orense, Rolando P. (MS Civil Eng'g.)**
Elasto-plastic analysis of plate bending using hybrid-stress finite element method.
1989.

A numerical method is presented, based on the assumed-stress hybrid finite element model and the initial stress approach, for the elasto-plastic, small deflection analysis of plate bending under static loading. The use of the initial stress approach results in a set of simultaneous linear incremental equations to be solved at each loading step, with the elastic stiffness matrix remaining unchanged throughout the loading process, and the effects of plasticity are incorporated as equivalent element loads.

Several example solutions are included to demonstrate the ability of this approach in elasto-plastic plate-bending problems.

CIV 8942 **Tan, Antonio (MS Civil Eng'g.)**
Elastic analysis of vertical floating pile group.
1989.

This thesis is about the static analysis of vertical floating pile groups subjected to vertical loads and moments. The study involves the elastic theory of analysis of pile-soil interaction based on the Mindlin Equation (MINDLIN, (3). proposed by H.G. Poulos and his co-workers (POULOS, (5). All piles are assumed to be vertical, free standing and the pile heads are rigidly capped, from which pile head moment are zero and lateral pile response induced from external loads are neglected.

CIV 8943 **Zabala, Milo C. (MS Civil Eng'g.)**
Artificial earthquake acceleration-time histories simulation and analysis using the Fast Fourier Transform (FFT).
1989.

The stochastic model that has been used extensively in the past to simulate a strong motion accelerogram is given as the superposition of harmonics modulated by intensity envelope function. However, there is no such attempt yet to device a method for faster processing (computer implementation) of the said model.

This thesis presents a new approach in the simulation of earthquake acceleration-time histories. The stochastic modelling is based on the established stastistical description of strong motion accelerogram. By taking advantage of the Fast Fourier Transform (FFT) technique, a random process (equivalent to superposed harmonics) is generated through the Fourier series representation

expressed in the form of Fourier integral.

CIV 9044 **Bambang Sulistiono (MS Water Resources)**
Regionalized synthetic unit hydrograph parameters for flood peak estimation in Central Java, Indonesia.
1990.

There are at least four methods of flood peak estimation used in Indonesia: empirical method, rational method, flood frequency analysis, and unit hydrograph technique. This study compared all the above method except for the empirical method.

Due to insufficient data in ungauged catchment, the synthethic unit hydrograph is applied. This method is a part of the unit hydrograph technique, whose use is limited to a region of similar climatic and geographical condition. Therefore, as a second objective, this study tried to regionalize a synthethic unit hydrograph parameters based on the catchment characteristics for the Central Java, Indonesia. The results showed that the synthethic unit hyfrograph technique gives better flood peak estimates compared to the rational method. Furthermore, since the climatic and geographical conditions of catchment area in Java Island are similar, the synthethic unit hydrograph may be considered applicable to the whole island.

CIV 9045 **Gumtang, Reynold J. (MS Water Resources)**
Effects of basin parameters on the streamflow characteristics of Region 1 catchments.
1990

Prediction and estimation of streamflow processes have been an area of concern for researches in the field of engineering hydrology. This thesis is basically an effort to develop prediction models by investigating the relationship of basin variables with maximum flows, minimum flows and

flow magnitude at specified percent time availability by using regression and correlation analysis.

The drainage basin of the fifteen river stations in region 1 (Ilocos Region) was analyzed. The basin variables, namely drainage area, stream count, stream density, stream frequency, main channel length, total length of channel, slope of main channel, topographic factor, soil index, extent of forest agricultural, grassland and shrubland areas, were measured and quantified for each watershed. A total of twelve rainfall stations within the region were considered. Area precipitation volume for each watershed was derived by using the Thiessen polygon method. Collected streamflow data were subjected to frequency analysis. The best fitting frequency distributions were selected, and magnitudes of annual maximum and minimum flows were computed for the design periods of 2, 5, 10, 15, 20, and 25 years. Similarly, flow duration curves were computed by using the class-intervals method, and the flow magnitudes at 25, 50, 75 and 95 percent time availability were evalluated.

Average catchment unit hydrographs were developed for selected catchments in the region using Collin's method of event superposition via the Gauss-Seidel iteration scheme and the restricted least-squares method.

The study revealed the existence of an inter-relationship among basin variables. The drainage area and its linear aspects, particularly the total length of channel, had been very significant factors in the estimation of maximum flows at different return periods. Topographic factor and extent of forest areas and grassland areas affected the variation of minimum flows. Upper portions of the flow duration curves were mostly affected by topographic factor, while the lower portiions were governed by the extent of forest areas, grassland areas, and drainage area. The unit hydrographs of some catchments were characterized by a rapid rise and sharp peak which were the results of high runoff in an area near the basin outlet. Peak discharges were significantly affected by the ratio of drainage area and time to peak.

CIV 9046 **Macam, Victor Jr. R. (MS Civil Eng'g.)**
A Study of the fatigue behavior of microconcrete model beams under a moving load.
1990.

Singly-reinforced microconcrete beams without web reinforcement were tested under a static load, a fixed-point

repeated load and a moving load. the beams have constant cross-sections - 5-cm. wide and 8-cm. high and varied span lengths of 40-cm., 60-cm., 80-cm., and 100-cm.

The results of the tests on microconcrete beams subjected to static load and fixed-point repeated load were found to be comparable with the results on normal concrete beams as reported in the literature. The fatigue characteristic of microconcrete beams subjected to fixed-point repeated load is similar to that of normal concrete beams.

Microconcrete beams under a moving load, Irrespective of span lengths; failed in shear. Furthermore, the fatigue strength of microconcrete beams under a moving load was found to be much lower than that of the beams subjected to a fixed-point repeated load. This behavior is attributed to the fact that under a moving load, the beam is subjected to a higher shear stress range than that of the fixed-point repeated load. Aside from this, as the load transverse the beam, all the points on the beam are subjected to a combination of high shear and high moment resulting in a complicated crack patterns and consequently, structural disintegration

CIV 9047 **Tandoc, Renato D. (MS Civil Eng'g)**
Rattan as substitute reinforcement in concrete beams and columns.
1990.

The fundamental strength properties of rattan relation to its function as substitute reinforcement and the influence of physical factors like moisture content, specific gravity and the presence of node upon these strength properties were evaluated using specimen shapes and test methods patterned after current ASTM Standards for wood and reinforcing steel. Minor revisions were implemented to suit the physical peculiarities of rattan.

Tests on full-sized concrete beams with 3.22% and 2.57% rattan reinforcement reveal the inability of rattan to delay cracking of the concrete. Excessive deflections and wide cracks were observed on the same beams just after the cracking load. No significant increase in load was carried by the columns with 3.48% percentage reinforcement as against the unreinforced columns.

CIV 9048 **Teguh, Mochamad (MS Civil Eng'g.)**
Elastoplastic hybrid finite elements in the analysis of shear walls.
1990.

A special finite element technique for plane problem is presented with rotational and translational displacements at the nodes. The finite element system involves either solid shear walls or coupling beams connected to shear walls in the state of plane stress. A 12 degree for freedom rectangular hybrid finite element is developed. It is based on the principle of minimum complementary energy employing assumed-stress distribution. The present assumed-stress model deals with the initial-stress approach for elastoplastic analysis of shear walls under static loadings. This approach leads to a set of simultaneous linear algebraic incremental equivalent equations to be accounted for at each step throughout the loading process and the effects of plasticity are included as equivalent element loads. A numerical implementation was also provided as a presentation of elastoplastic program.

CIV 9149 **Alcantara, Pablo R. (MS Civil Eng'g.)**
Matrix structural analysis of multistorey three dimensional building frames considering P-Delta effects.
1991.

A computer method for the structural analysis of multistorey building frames subjected to lateral loads is presented. The analysis includes the secondary effects specifically the P-Delta and the effect of high axial compression load in column flexural stiffness but neglects axial and shear deformations in the members. St. Venant and warping torsion of the members are assumed to be negligible compared to warping torsion of the building as a whole.

The development of the structure stiffness matrix of order three times the number of storeys is based on the superposition of lateral stiffness if subframes in the principal axis directions of the building floors. Lateral stiffness matrix of each frames are formed systematically by

static condensation of the subframe stiffness matrix leaving only the lateral forces and deformations. From the method presented, a computer program (EQUASIS) is based and developed in Pascal language.

CIV 9150 **Botuyan Allan E. (MS Civil Eng'g.)**
Elastostatic analysis of single core shear walls subjected to lateral loadings using isoparametric finite element method.
1991.

An elastostatic finite element analysis of single core shear walls flat shell element is presented. The flat shell element is a combination of a membrane plane stress element and a plate bending element. The analysis being three dimensional considers the out-of-plane deformation of the flat shell element (i.e. the out-of-plane displacement of the slab connected to the core shear wall).

A numerical method is implemented in a computer program called shell Element Analysis Systems (SEAS). Several illustrative models, representing slab-core wall structural combinations, are presented. These include combinations of slabs, walls, and columns acted upon by static lateral loads.

CIV 9151 **Deng, Chaoqi (MS Civil Eng'g.)**
Stiffness matrix of non-uniform members including the effect of axial forces
1991.

The stiffness matrices of four kinds of non-uniform elastic columns subjected to end moments, end shears, and with or without axial forces are derived through the use of fourth order differential equations. An illustrative example for an isolated column was solved. The results compared well with the results of Timoshenko and Ghee for the same column. So the stiffness matrices can be readily extended to deal with stability analysis of rigid frames with non-uniform members.

CIV 9152 **Guadalquiver, Arturo N. (MS Civil Eng'.g)**
Knowledge-based expert systems in the design of structural members: Applications to continuous post-tensioned beams.
1991.

This research presents knowledge-based expert systems (KBES) in the design of structural members with applications to continuous post-tensioned beams. discussions on expert systems' application to structural design are presented. The prototype system runs on an IBM PC/XT or IBM PC/XT compatibles with 640 K RAM. Prior to design, structural analysis is performed by subdividing a member into finite elements. The numeric-intensive algorithms utilized by the KBES are written in a procedural language Turbo C, while the non-structured and symbolic knowledge that drives the design process is mimicked using an expert system shell, VP-Expert. Demonstrations of the system are also shown.

CIV 9253 **Bautista, Romeo T. (MS Civil Eng'g.)**
A study of some building foundations in Dagupan City as affected by the 1990 Luzon earthquake using database management.
1992.

A study is presented on the foundation systems of some buildings in downtown Dagupan City, Philippines as affected by the 16 July 1990 Luzon earthquake using a database management system.

The said earthquake caused severe damage to many buildings due to liquefaction. The purpose of this study is to determine the different types of existing foundation systems of buildings in the area based on available foundation plans, in relation to the earthquake performance of the buildings based on field evidences. A program using the facility of database management system is provided to organize and correlate the data gathered in the survey of multistory buildings in Dagupan City.

CIV 9254 **Lim, Winnifred H. (MS Civil Eng'g.)**
A study of the mechanical properties of cement bonded coco excelsior board for use as a construction material.
1992.

Wood-cement composite has great prospects in tropical and developing countries like ours. It is because of its weather durability, incombustibility and low cost that make this a good alternative to other conventional types of building materials. However, the technological information available is limited. It is yet to be exploited to our fullest advantage.

This study of the mechanical properties of Cement Bonded Coco Excelsior Board (CBCEB) for use as a structural material in low-cost housing construction could make possible the use of our limitless agricultural waste products such as the coconut palm wood.

Findings in this study revealed that a strong and cheaper cement-bonded coco excelsior board can be produced at a high density level of 1250 kg/m^3 with the combination of 40/60 wood/cement ratio, 60% water and 3% calcium chlorides based on cement weight. Boards made at this optimum manufacturing condition surpassed the strength required by Japanese Industrial Standards (JIS A 5404-87) for wood-wool cement board.

CIV 9255 **Noor, Ilman (MS Civil Eng'g.)**
An alternative method of plastic design of x-braced multi-story frames.
1992.

The plastic design solution is solved by this study and compares well with that of Driscoll et. al, (1965). The study shows that plastic design method results in simpler equations for calculations which translated to savings, timewise and moneywise, as compared to that of the allowable-stress method.

CIV 9256 **Palmiano, Leon IV B. (MS Water Resources)**
A comparative study and application of single shot noise models.
1992.

Shot noise models are relatively new class of streamflow models. These models were developed in an attempt to reproduced the asymmetrical behavior of daily streamflow data; typically a steep rise coupled with an exponential decay. The performance of these models, in rivers located on various areas classified under the coronas climate classification, was evaluated by this study. Six slightly different models (three of which were called seasonal and the other three were referred to as harmonized models) were fitted to four rivers. Seasonality was introduced in the harmonized models, by taking the harmonic representations on the raw daily statistics. Then the test for the adequacy of the models as well as the degree of model fit was primarily measured in terms of the reproduction of the historical statistics. Results indicated that most of the models reproduced the lag-one serial correlation coefficients very closely while the mean and standard deviations were likewise adequately preserved. However, the reproduction of the skewness coefficient varied among the models. Moreover, the models showed appreciable differences in the simulation of the extreme values and total discharges.

CIV 9257 **Tago, Aj Udtog M. (MS Civil Eng'g.)**
Structural design and construction of decorative ferrocement conoidal dome for muslim mosques.
1992.

This study is an effort towards the continuing education on ferrocement construction and application particularly in this country. It is a response to the recommendations of the ACI Committee 549 namely: the development of guide and recommended practice; the development of simplified method of analysis and design; and the development of effective, efficient and economical

fabrication and construction procedure for ferrocement structures. This is geared along the idea of transfering technology for the majority of the people particularly those in the rural areas in order to achieve a balance growth of society. The study is generally aimed to derive at a simplified procedure for both design and construction of ferrocement dome for use in the Muslim communities of Southern Philippines. Specifically, this is meant to determine the status of completion of the mosques in Lanao del Sur and Marawi City, the available materials for ferrocement in local market, the theoretical basis from which to derive the simplified design procedures, and to find an effective construction procedure of the dome.

It is concluded that ferrocement is a sound alternative for the construction of conoidal dome because of simplicity in the design, analysis, and construction procedure, assurance of durability and aesthetics, relatively lower cost compared to conventional concrete, and local availability of the materials required.