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OPENING ADDRESS

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I am most grateful to the Organizing Committee of this Fifth International Conference on Expansive Soils for having invited me to deliver this Opening Address. Last week I had the privilege of addressing the Australasian Regional Conference in my condition of President of the International Society for Soil Mechanics and Foundation Engineering, and the principal message was of genuine appreciation for the many initiatives of true leadership contributed to the world geotechnical community by your Region. Needless to mention the scientific and technical strength of your Geomechanics Society within our fold; my intent was to emphasize the breadth of vision with which you have maintained united the full scope of Geomechanics that in many areas of the world is subdivided into Soil Mechanics, Rock Mechanics, and Engineering Geology - and that continually risks being further subdivided. Unity is strength: let us guard it zealously.

But unity through oversimplification brings staleness inevitable: let us forever instigate differentiated enthusiasms within the family.

At this gathering I am especially happy to greet a group that, when the world was occupying almost every effort in conventional soil mechanics of soft saturated clays and pure uniform silica sands, had the merit of yielding to a passionate interest in a totally different soil condition. In the beginning was remoulded Boston Blue Clay and Ottawa Sand, and in Erdbaumechanik clays and sands were the Word. Fortunate indeed that quite early the Aztec serpent from Mexico City clays' smectites seduced innocent geotechnicians to taste of the fruit of curiosity, opening the door to knowledge of good and evil ---- the knowledge of the extremes occurring side by side in Nature's routines.

Does difference portend subdivision? I submit that on the

contrary, the cognizance of difference generates knowledge and curiosity, in endless cycles. I propose in earnest that we might join Chesterton in challenging the dictum "in media virtus": there is no "virtus" but only "mediocritas" in "media" (average), and true zest and virtue derive from a well balanced compensation of extremes. In dedicating this International Conference to a very special condition of subsoil quality and behavior, you are adding zest to our endeavours with the now more conventionally treated soil mechanics problems. I greet you heartily in the name of ISSMFE, and recall with gratitude the milestones set by the 1960 Conference on Pore Pressure and Suction in Soils, and the four previous International Conferences on Expansive Clay Soils (Texas 1965, 1969, Haifa 1973, and Denver 1980).

In essence you established yourselves hors-concours as a would-be full-fledged International Technical Committee on a special type of soil and subsoil condition. When I took office in June 1981, two Technical Committees of ISSMFE had been engaged in producing what would be unified manuals, one on Field and Laboratory Testing of Soils, and the other on Soil Sampling. There were at least three principles involved which to me seemed to require urgent and radical reconsideration. One was the question of Manuals and Standards, and in particular, of such codifications being elaborated and emitted by the International Society. The other was the fact that if presumably all soils were to be treated jointly, we would be glorifying a minimum common denominator, of essentially no value to the refinements to which each of us is taxed in professional practice in his particular subsoil and environmental conditions. Finally, the third would suggest that if the complementary functions of field and laboratory testing were to be subdivided, the rational subdivision would be of Field Testing on the one hand, since it produces an independent end product, and Soil Sampling and Laboratory Testing on the other, since one cannot dissociate Sampling from the laboratory use that is made of the respective specimens, with whatever questioning and reevaluation necessary.

The basic fact is that in reorganizing those Technical Committees I preferred to emphasize in the Sampling and Testing Committees some of the more significantly differentiated soil types and conditions. Thereupon we are now working on Residual Soils and Saprolites, Sand-Gravels, Tropical Laterites and Saprolites, Submarine Soils, Soils of Volcanic Origin, and the Indurated Clays and Soft Rocks. The cases of Expansive Clays and Collapsive Soils were recognized as of priority, but in tribute to such eminently successful efforts as those of this group, we preferred to start from a position of respectful observation and emulation. In the past four Conferences, one (Haifa) is reported as having been "sponsored" by ISSMFE, and one (Denver) as having been "sanctioned" by ISSMFE: whatever those officialized names might mean, the fact is that our institutional co-participation has been minimal, while it is through personal charisma of many of our foremost individual members (such outstanding names as Spencer Buchanan, Jennings, Aitchison, and many others), that the unity with the universality concepts of ISSMFE was preserved and enhanced, despite or because of dedication to a specialization.

Geology, and Soil and Rock Mechanics, towards enhanced Civil Engineering! We must firstly face every geotechnical problem within the macrocontext of geology. If in our endeavour at simplifying and idealizing mental models for analysis and synthesis we stumbled into compartmentalizations, presumably it was for pragmatic reasons of benefit/cost ratio: subdivisions into distinct categories are arbitrary determinisms, since geologic reality presents itself to the careful observer as a continuum, and since the end-product of our profession, civil engineering synthesis, also pays no heed to where we decide to stop calling a material a dense soil to start calling it a soft rock. Indeed the basic keynote of Nature is the continuum and essential similarity, made beautiful by the infinitesimal variations across myriads of specimens that have been successfully differentiated to preserve an equivalent right to survival. Lucky we are, indeed, inasfar as by being attracted only to a few salient points at a

time we can draw the exhileration of perceiving differences: let it be for learning to cherish differences and to enjoy the pleasures of cross-fertilization by intuitive and analytic analogies where many would but see apathetic homogeneity.

What of expansive clay soil conditions? Can we really meet the increasingly exacting demands of Society by merely making amendments to the techniques generated for and adapted to conventional geotechnique? Is not the yes-no guillotine of decision, expansive or non-expansive, a nominal classification, based on predictive index identifications, purely relative to the building's tolerance, that is, Society's demands?

On the other hand, should we not distinguish between scientific truth of soil science, and the practical level of engineering's transitory truth? Will we not be failing our fellow-citizens, the lay in civil and geotechnical engineering, if we do not give them a fair assessment of engineering as DECISION DESPITE DOUBTS, to provide SOLUTIONS MINIMIZEDLY BETTER THAN REASONABLY PREDICTED AS NECESSARY (statistical confidence bands), AT PRESUMED CONDITIONS OF OPTIMIZED RATIO OF (INCREMENTAL BENEFIT)/(INCREMENTAL COST)? Should we not publicize that since the PROFITS and therefore RISKS are of the OWNER ("no taxation without representation"), our well engineered projects should be submitted as a curved band of results permitting to the Owner his easy assessment of dispersions and of parametric variations? Is not the client the one to choose consciously where he wishes to place himself, within the continuum of reality?

Personally I tend to fear for young professional geotechnicians who follow us, because our fellow citizens continue to be fed the notion that there is certainty and an "exact science" behind us. Meanwhile the reality ironized by Mark Twain's statement "Civilization is a limitless multiplication of unnecessary necessities" has reached the culmination of absurdity wherein highly sophisticated industrial contents of a building are made to become obsolescent every few years, by precisions that impose such exacting requirements on the geotechnical engineer as to require him to guarantee ser-

viceability against increasingly remote probabilities (e.g. 1:10000 year recurrence of meteorological events, etc.). Where is the method in such madness? Why is the world becoming unbearably expensive for everybody, for poor and rich: is it not because we arrive at requiring too much, at trying to be gods against Nature rather than the humble engineers drawing utmost cooperation from Nature? Everywhere we head directly, unquestioningly, into making the "containers" cost more and more in comparison with the "contents" that benefit of the economy of multiples.

What environmental conditions, and changes thereof, are to be considered or worth considering, within our professional terms of reference? What inexorable trends of change are wrought by "progress" itself, and what "final" stabilized condition will be reached?

In the strictly geotechnical area, we do know that philosophically there are no two soil elements exactly alike. All our thinking and computations are based on "homogeneity" or, at most, on a mathematically statistical dispersion within a fixed universe. But, as we delve further and further into minute details, important intervening factors become salient.

This audience is more than aware of the countless infinitesimal factors that establish trends and dispersions of consequence as regards expansive clay heave: geologic history, presumed stress history, incremental stress trajectories, clay mineralogy and clusters, adsorbed cations, pore fluid and chemistry thereof, micro-cementations, microfabric, total and osmotic suction, pore-size distribution and pore-air conditions (still dualistically subdivided into occluded vs. fully interconnected), sample disturbance, testing and test interpretation techniques, assumed incremental effects and computational models thereof, and so on, and so forth. All such subjects will be treated in detail by this Conference, as has been done at previous instances.

I take the liberty to emphasize three points: Firtly, that expansive clay subsoil is inexorably subject to great dispersions. These soils have been subjected to high stresses (overburden, drying, or other) but are being analysed at conditions near surface, close to zero. Any scientific

investigation of parameters X = f(y), close to the (0,0) coordinates is inevitably subject to great errors, all the more so when the present condition close to zero is reached by widely divergent hysteretic conditions in returning from the high historic stress.

Secondly, that we must consciously separate routine conventional soil mechanics tests, indices, correlations, etc. as too crudely conceived for the microscalar effects at play. How can a routine liquid limit test ever be fruitfully considered, when no consideration is given to quality of water, changes of cation contents, etc.? How can a swelling index be correlated merely with one (crude) Atterberg index (e.g.Ip) when at least two such indices would be necessary to define the coordinates of the soil on the Plasticity Chart? How can we be satisfied with so-called "undisturbed samples" and the effects of unquantified disturbance, when in conventional soils the strain behaviors of "perfect" and "intact" samples have already been proved noticeably different?

Thirdly, that we must urgently gather data as to the tolerable limits of cracking by heave. There is an intuitive conviction that differential heaves are more damaging to houses and structures than the numerically equivalent differential settlements. Is that true, and what criteria could be offered, technically, for the limits of tolerance? In the field of unallowable differential settlements we owe the first indications to Terzaghi and Peck (1948) and Skempton and Mac Donald (1956). There is an ISSMFE Technical Committee working to revise the available indications, and one of the important suggestions has been to shy away from interest in the "initial cracking" (subject to major dispersions, "close to zero", statistics of extremes of weakest link) and in substitution, to gather voluminous statistical data on Δcrack vs. $\Delta(\Delta$settlement).

I would suggest that in the case of the thousands of residences, etc. plagued by heave, we should really devote ourselves to gathering instructive data on Δ crack vs. Δ (differential heave). It is much cheaper a program because we instrument only after the crack has started,

minimizing the instrumentation program to situations that contribute effectively. At any rate, there are three levels of criteria to be established. The first is the purely TECHNICAL, plot of the statistical universes of Δ crack vs.Δ (Δheave), for extrapolation backwards, for improved definition of meaningful initial cracking, and for extrapolating forwards for prediction of what will be the likely advances and limits of damage. The second is the criterion for the CLIENT: different levels of heave damage lead to stepped engineering and cost decisions regarding repairs. It is important to establish the bar diagram of incremental corrective costs vs. incremental heave damage. This is indispensable for the client to take conscious decisions, and for minimizing geotechnician - client attrition. Finally, there is the third level, of relationship between geotechnician and collateral professions (architect, etc.) and with PROFESSIONAL PRACTICE abstractions. Who will be willing to throw the first stone? Is it not generally the most ignorant?

In closing this message, I earnestly request you to maintain continual close interchange with some of the Technical Committees of ISSMFE. I have already mentioned the Sampling and Testing Committees dedicated to specialized problems and techniques related to peculiar soils. Further, you are continually needing to define new UNITS and SYMBOLS and CORRELATIONS: there is a Committee working on that, and it needs to incorporate valid new input. There is the Committee on POLICY REGARDING MANUALS AND STANDARDS; would it not be terribly detrimental to have such dictates based on the "conventional majority" soil behaviors? There is the Committee on ALLOWABLE DIFFERENTIAL DEFORMATIONS. And there is the Committee on PROFESSIONAL PRACTICE: surely they could help in cases of litigations, by establishing objective and serene recognition between the professional calling of best possible service, and the stifling worries of incomprehension regarding exact science and guarantees!

And there will be other Technical Committees, in response to your wishes, to serve you in proportion to the service you render to

Society through them. That is what the International Society for Soil Mechanics and Foundation Engineering is all about. Unity and strength through cherished diverse specializations. Ask not of the Society what it can do for you, but what you can do for it: and the harvests will be reaped ten-fold and hundred-fold.

Heartiest wishes for a most succesful and enyoyable conference.