

N.Z. GEOMECHANICS NEWS

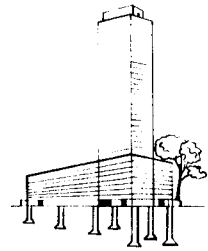
No. 5

NOVEMBER 1972

A NEWSLETTER OF THE N.Z. GEOMECHANICS SOCIETY



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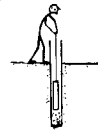
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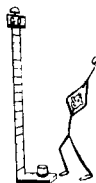


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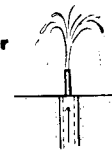
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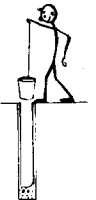


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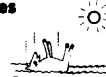


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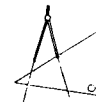


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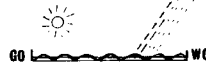


QUOTE - PAYOUT

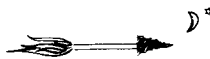
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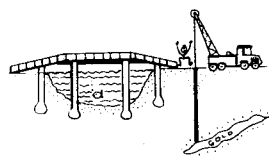
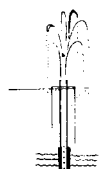
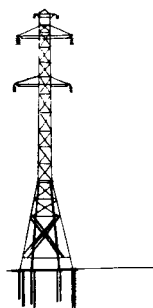
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N.Z. GEOMECHANICS NEWS

No. 5, November 1972

A Newsletter of the N.Z. Geomechanics Society

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THIS IS A RESTRICTED PUBLICATION

"N.Z. Geomechanics News" is a newsletter issued to members of the N.Z. Geomechanics Society. It is designed to keep members in touch with recent developments. Authors must be consulted before papers are cited in other publications.

Persons interested in applying for membership of the Society are invited to complete the application form at the back of this newsletter. The annual subscription rate is at present three dollars. For 1973 the annual subscription will vary depending on which International Society the member wishes to be affiliated to.

EDITOR'S NOTES1. Engineering Geology in New Zealand

We present as our feature article in this issue a contribution by Dr Martin L. Stout, Professor and Chairman of the Department of Geology, at the California State University, Los Angeles and a member of our Society. Dr Stout spent a number of months working in New Zealand in 1970-71.

Dr Stout's article entitled "Engineering Geology in New Zealand" will undoubtedly raise some controversy. We welcome controversy in "N.Z. Geomechanics News" as long as opportunity is given for all sides of an argument to be fairly expressed. We hope that we may receive many more contributions from engineering geologists in the future because only as we do so will "N.Z. Geomechanics News" be a balanced geomechanics publication. If our newsletter is dominated by engineers talking about soil mechanics and foundation engineering then engineering geologists will have nobody to blame but themselves.

2. Wanganui Symposium

We report on the recent symposium on "Using Geomechanics in Foundation Engineering" held in Wanganui on 1-2 September. The local organising committee did a first class job and the facilities provided were admirable, demonstrating conclusively that such a symposium can be run successfully outside of the larger cities. However they must have been rather disappointed that the attendance from outside the Wanganui area was not rather larger - we hope that this does not indicate a lack of interest in geomechanics but rather that too many conferences and symposia are now being organised within the space of a few days over the May and August school holiday periods. Perhaps it is time that some organisation, perhaps the New Zealand Institution of Engineers, began to co-ordinate the timing of all these conferences and symposia.

The sub-committee of the Society in Wellington also did a good job in obtaining the papers and putting them together and the authors are also to be thanked and congratulated for their efforts. We await with anticipation the production of the Conference Proceedings which should attract a ready sale, as did the proceedings of the Site Investigations Symposium held in 1969.

3. Soil Engineering in Indonesia

We also present some impressions from Laurie Wesley on living and working in Indonesia. As New Zealand increasingly sees for itself a role of influence in South East Asia, more and more New Zealanders with technical backgrounds are likely to find themselves working there for limited periods, either on aid projects or on work obtained directly in competition with organisations from other countries. For this reason Laurie's comments on some of the problems he has encountered should be valuable to a number of our readers although it must be emphasised that they are opinions of one man living and working in one country of South East Asia and are therefore not necessarily completely typical either of that country or of South East Asia as a whole.

We wish Laurie well as he leaves Indonesia late this year to study for a doctorate in soil mechanics at Imperial College, London.

4. Drillers and Engineers

Also included, is a short article on "Involving the Driller in Soils Investigation Work". Effective communications must be of extreme importance if a site investigation is to be carried out properly. If the driller is regarded as a full member of the site investigation team and is put completely in the picture as to the aims and objectives of the investigation and what he is expected to achieve he is likely to produce much better results than if he is told merely to "go out and drill half a dozen holes".

We hope that this article will spark off further contributions about drilling and also contributions by drillers. A number of drillers joined the Society after the Site Investigations Symposium in Christchurch in 1969 and we would be very pleased to hear from them.

5. Sequel to a Court Case

We report on a judgement by the New Zealand Court of Appeal reversing an earlier Supreme Court Judgement reported on in "N.Z. Geomechanics News No. 2" in which it was held that an excavation made immediately adjacent to a heavy concrete wall was not the reason for the collapse of the wall, but rather the weight of the wall itself. By reversing this decision the higher court has demonstrated that the spirit of reasonableness and common justice is more important than the exact letter of a law based on an English court decision made in 1881. Equally as important from the geomechanics point of view is the fact that foundation engineers will now be able to sleep peacefully at night confident that foundations for their buildings cannot now be undermined with impunity by adjacent excavation.

6. Contributions Still Wanted

Contributions to New Zealand Geomechanics News may be in the form of technical articles, notes of general interest, letters to the Editor, or book reviews and may cover any subject within the fields of Soil Mechanics, Rock Mechanics and Engineering Geology. Articles on site investigation, or construction techniques or design methods which have been successfully used in New Zealand and which would be of help to other members would be particularly welcome.

All contributions should be sent to:

The Editor,
New Zealand Geomechanics News,
C/- New Zealand Geomechanics Society,
P.O. Box 12-241,
Wellington.

J.P. Blakeley
EDITOR

ENGINEERING GEOLOGY IN NEW ZEALANDM.L. Stout*Introduction

It is commonly felt that geologists and engineers live in different worlds when it comes to nomenclature, qualitative-quantitative relationships, and understanding of each other's problems and data to be considered. In many areas of the world, the gap between the engineer and geologist has been considerably decreased; in some even eliminated, and in others, simply remains unchanged or possibly even widened. The gap is real in New Zealand, although a few individuals have been successful in partially or completely bridging it. The trend appears to be firmly set to narrow it during the next few years.

The N.Z. Geological Survey

Geologists with the New Zealand Geological Survey have been called upon primarily to evaluate hydro-electric sites, tunnels, and to some extent road/rail alignments and other large scale construction projects where potential problems were foreseen, or problems developed during construction. In addition, some small project sites are evaluated, but this is not common practice. Most detailed site investigations are left to government or consulting engineers, although geological advice may be sought at times during the site investigation.

The Geological Survey has undertaken geologic mapping of the growing urban areas on a scale of 1:25,000 in an effort to gain more useful geologic information for engineering and design purposes. These maps are now being published with soil and rock data which can be used as background for general engineering investigations. They are not to be taken as the final map for detailed engineering geological investigations. The Survey also undertakes minor engineering geology in the planning stage with a review of certain Town & Country Planning maps. However, in the course of all of these investigations, different geologic parameters may be emphasised because the geologists (or engineers) have somewhat different backgrounds and perspectives. The result of this diverse approach can lead to negative reactions on the part of either the engineer or the geologist on a particular project.

Engineering Geological Recommendations

At present, recommendations of the geologist or engineering geologist on a project may be accepted or rejected by the supervising engineer, or in some cases the contractor. This tends to make the geologist somewhat wary of making firm recommendations. From my observations, engineering geological recommendations made on active construction projects seem to have more impact than "preventive" recommendations made for Town & Country planning purposes or for highway-rail alignment studies. While this may insure the stability of a dam site which will cost several million dollars,

* Professor Stout spent the 1970-71 American school year in New Zealand as a N.R.A.C. Senior Research Fellow with the Geological Survey. He is Professor and Chairman of the Department of Geology, California State University, Los Angeles and Senior Engineering Geologist for Moore and Taber, Inc. He is both a Registered Geologist and Certified Engineering Geologist in California. Dr Stout has given permission to quote from any part of this article.

it may leave the residents living on a landslide of questionable stability in Taihape with some feelings of uncertainty. Preventative work in such a case costing very few dollars may save several thousand dollars and certainly human anguish in the final analysis. Similar landslide problems also exist in the urban areas of Auckland, Wellington, Nelson and Dunedin.

Geological Description

Emphasis on geologic mapping in New Zealand has traditionally been from a time-stratigraphic viewpoint. Because of this approach, some geologists feel that determining the geologic ages of rocks at a construction site is of the highest priority, yet rarely is this true. Even if age becomes critical in a study, such a separation of similar-appearing papa rocks in a massive and complex landslide, it is usually not necessary to discuss the various faunal lines of evidence leading to the conclusions. The age of the strata can be expressed in one or two words, describing epoch or period, and these can usually be incorporated as adjectives in a longer sentence describing important rock types. There is no difference, from an engineering viewpoint, between Precambrian and Cretaceous granodiorites. Other geologic conditions being equal, montmorillonite in Paleocene sedimentary rocks behaves no differently than montmorillonite of Pliocene age from a slope stability or expansive soil viewpoint.

Geological description of rock types are commonly burdensome and long, and usually unnecessary for the preliminary or even final engineering geologic report. For example, separation and identification of potassium and plagioclase feldspars is only important if alteration or differential weathering is related to their presence, or if different grain sizes of each mineral cause a significant change in the compressive strength of the rock. If detailed percentages of all minerals are to be included, the question must be asked as to what value they are to the engineer. For example, percentages of impurities might be extremely important to the economic geologist, but rarely would they be significant in a typical engineering investigation.

Any mineral or group of minerals which contribute to a rock's weakness, not strength, is certainly of keen interest and should be explored in adequate detail. Unfortunately, these minerals are commonly clays and fine-grained materials, and as such may be very difficult to study, but this in no way should be used as an excuse, for the geologist is almost always better equipped to study these from a chemical and mineralogical viewpoint than the engineer. On the other hand, the engineer is usually better equipped to handle the wide range of mechanical tests on these fine-grained rocks, and these tests may be more significant to the engineering aspects of the project than the mineralogical aspects supplied by the geologist. However, the engineering geologist can supply pertinent information on the distribution of the fine-grained materials on the site, their orientation, weathering, etc., and this produces a well-balanced and complete engineering geological investigation.

Soil and Rock Defects

Soil and rock defects of any type should always gain most attention in an engineering investigation involving questions of stability, because the weak link controls all rocks around it, by virtue of the low tensile strength of most rocks. This is best exemplified in Central North Island, around Taihape. Most of the papa is remarkably stable resulting in vertical and undercut river banks several hundred feet high. Thin montmorillonite layers in this section have caused several tens and possibly hundreds of

deep-seated massive landslides in the region between Wanganui and Taihape. If rocks are to fail in a slope or under a dam, weaknesses and, in cases of planar elements, their orientations in respect of proposed construction, are most important. If weaknesses are absent, which is very rare, then the strength of the rock can be properly studied and emphasised. Soil and rock defects can be very difficult to study from a geological viewpoint, because they are not readily apparent on the surface or in small diameter borings. Weaker materials at the surface may allow channels or ultimately valleys to develop in them, or thick soil to form over or within the defect, resulting in seemingly complete obscurity. Harder and stronger rocks stand nicely on the surface waiting for the geologist's pick. Cores in hard rock offer fresh continuous exposure, look sound and are usually geologically attractive because of the freshness, but the clay on a thin sheared zone 1 mm. thick is washed away or interpreted as shear due to drilling or even possibly taken for drilling mud. The geologist's education and training emphasises the value of hard, fresh rocks, yet rarely is this the condition in the zone of oxidation that the engineer is concerned with: the 100 feet just below the surface.

On the other hand, the freshest and soundest rock in an ignimbrite layer may be of utmost importance to a contractor who is submitting a tender for earthmoving. To him, the question of how much material is so strong and fresh that it will have to be shot may be much more of an overriding consideration than slope stability or compaction of fill. However, rock defects could also give some measure as to the ease of excavation, and these usually show up well in seismic profiles carried out in conjunction with detailed geologic mapping.

If a thin sheared surface or joint is covered with clay, such as in the Utiku Slip and most other landslides in that area, the clay, not the rocks around it, must be sampled for soil testing for a thorough slope stability analysis. This may require tedious digging to obtain an undisturbed sample containing the layer, or scraping over a large area of the sheared surface to get the few cubic inches necessary for shear tests, but this effort to get the material will give the engineer the most reliable data to use for slope stability calculations, particularly if residual shear values can be obtained for the clayey materials.

Slope Stability

Semi-quantitative estimates of slope stability based on height and slope of apparently stable existing natural slopes are prone to errors and have to be critically evaluated. While the logic might work well for the rare homogeneous materials, no allowance is made for heterogeneous materials, possibly complexly intermixed, or even worse, the planar or semi-planar rock defect which remains not expressed in the existing landscape. For example, a massive sandstone exposed in a sea cliff could easily support steep, high slopes; yet with 15-20 feet of additional removal of material by either the sea or man, an underlying shale or clayey rock might allow a failure to occur. Similarly, a sheared clay layer or joint with weathering along it in greywacke, which may be adversely oriented for a particular batter, might fail with construction; yet the material removed for the batter could easily have been of high-quality greywacke, supporting high, steep slopes, and even requiring considerable blasting for removal. This situation seems particularly critical in the Wellington area.

From an engineering geological viewpoint, the thickness, distribution and orientation of clayey layers or sheared zones are the most critical elements for slope stability analyses. This data should be supplied by an engineering geologist who obtains it from test pits, borings or seismic evaluations. Judgement and responsibility play a major dual role here, for

the engineering geologist alone must be able to change a projected drilling program, even while underway. The writer frequently decides the location of the next large diameter boring only after inspection of the preceding one. Predetermined locations based on grid networks, or minimum spacing along an alignment can yield extremely inadequate and unreliable data, as well as being very uneconomical.

Faults

In New Zealand as in California, faults also come up as an alarming element. Many geologists (and engineers too) feel that the discovery of a fault surface, fault zone, or sheared area automatically introduces problems into the project. In this manner, undue alarm may be raised. This is not to de-emphasise the very important recognition of active (Class 1) faults and the potential for reactivation, but faults which are old and have not moved for several thousand years should not be treated with the same concern or approach as those which show movement within the past few hundred years or even show active tectonic creep. At worst, these older faults may present localised foundation problems which can usually be solved by minor design changes. An extremely hot issue at present is the definition of an active fault, which can be adequately defined by both geologic and engineering parameters. Radiocarbon dating has helped to determine ages of several faults, but has not solved the entire problem. For example, the last movement along a fault in Southern California was 100,000 years ago - the engineering question still remains, "Can a nuclear reactor be safely built on it?" My feeling is that this fault is much safer than the Mission Hills thrust and related faults which produced the 1971 San Fernando earthquake. Even though some reports suggest that these faults were "inactive" until that quake, there is abundant evidence showing that tectonic creep had occurred on at least a portion of this fault zone during a 20 year period preceding the quake. Much more data is needed on the recent history of faults (last 10,000 years) in New Zealand, and particularly in the Wellington area, before more refined engineering recommendations can be made.

Faults have been used by geologists to explain many topographic and geologic features; some correctly, but others incorrectly. Sheared zones may be indicative of faulting or landsliding; sometimes with only surficial exposures, it is not possible to distinguish these two apart. This is an extremely critical problem in Wellington where both massive landslides and numerous faults are present. Faults may be used to explain the development of a valley or a portion of it, particularly if the valley is linear. This certainly is true in places, but again some geologists go to the extreme and interpret most valleys as the result of faulting presenting a spectacular (and difficult to explain) dendritic or crescentic fault pattern. Bulldozer trenches in Southern California show that faults commonly are very happy to stay on hillslopes, not valleys, and even have the audacity to follow the highest portion of a ridge. Obviously, this excludes major fault lineaments such as the Wellington or San Andreas "rift" zones.

Landslides and faults have also been pegged together in many instances without direct proof; in fact, the presence of widespread landsliding has even been used as evidence suggesting underlying faults. This concept must be carefully evaluated, for while it is true that some fault zones are of the magnitude that widespread weakening of the rocks has resulted in landsliding, subsurface exploration of several hundred landslide areas in Southern California shows no underlying faults. Even landslides along or in a fault zone are commonly caused by other geologic parameters, not directly related to the fault.

Conclusion

In the final analysis, engineers and geologists must develop the utmost respect for each other -- recognise the unique functions, observations, and limitations of each, and work together to not only produce a well-integrated and complete report, but to develop to the extreme that most valuable of all traits and possibly most elusive -- judgement. When all of the data is available on a project and digested in its entirety, decisions must be made, and rarely will they be based only on a few soil tests, dip and strike readings, and other casual observations. The experience of the individual with similar rocks and projects is also going to play a major role in making that decision.

REVIEW OF GEOMECHANICS SYMPOSIUM, WANGANUI, SEPTEMBER 1972W.M. Prebble

The Wanganui Branch of the N.Z.I.E. deserves to be congratulated upon the smooth organisation which ensured an effective and most enjoyable Symposium.

In the day and a half that delegates from as far north as Whangarei and as far south as Dunedin congregated at the Memorial Hall complex, 8 papers were delivered with considerable documented discussion on each.

The papers were well conceived, and contributed much to the field of the soils investigation aspects of geomechanics. However, from a rock mechanics point of view, the conference was virtually devoid of contributions in this field, or in the broader field of engineering geology.

A suggestion for the next symposium could be to have some engineering geologists present their current techniques for the analysis of problems such as the stability of rock slopes, stability of dam foundations and the selection of tunnel routes. Each of these are fields in which New Zealand engineering geologists are gaining increasing experience.

Although the authors did not include engineering geologists, much of the logic behind the papers was fundamental to sound site investigation practice and in this respect was familiar discussion and was appreciated by the engineering geology section of the audience.

The first session highlighted the importance of a thoughtful approach to site investigation and emphasised the need for flexibility in the investigation and its associated testing programme.

In the second session, emphasis was laid upon obtaining the right information for the design of foundations at the minimum cost. In this respect most of the experience upon which the papers drew came from soils investigations for high buildings.

In the third session the importance of obtaining sufficient site investigation to make sure a project is viable before letting contracts was emphasised, particularly for the case of large projects. A plea for the contractors was made forcibly, including the rather novel suggestion of including the contractor as part of the design team. This was advanced as a means of helping to solve difficult problems at minimum expense, and raised the question of giving the contractor adequate information on ground conditions at the time of tendering. It was generally agreed that it is unfair to give the contractor misleading information and to expect him to bear the responsibility. Conversely, it was pointed out that contractors should make increased efforts to ensure that they have sufficient and correct information before committing themselves to a job.

Another recommendation from many members was that the person responsible for a site investigation report should be on site when the foundation excavation is opened up, as a follow up to the predictions made and to assist with any construction difficulties. Equally important is the need for more field measurements of the performance of structures, but this type of instrumentation must be correctly and thoroughly executed to be of value.

The proceedings of the conference (which will contain the papers and a record of the discussion) are eagerly awaited and members no doubt look forward also to the next symposium when we may expect increased participation among both authors and audience.

A LETTER FROM INDONESIA

We present below some impressions received recently from Laurie Wesley on living and working in Indonesia. Laurie, who will be known to many of our readers has spent the last four years working in Indonesia under the Colombo Plan and previously spent a similar period there under the N.Z. Universities Volunteer Graduate Scheme in the early 1960's.

The Country and Its Local Soil Conditions

Indonesia makes claims to many things (fifth largest population in the world, over 3000 inhabited islands, several hundred languages and so on) but Laurie is not aware of it yet laying claim to having the most interesting soil conditions of any country. However it could well make such a claim as just about every conceivable type of soil seems to be found here.

The two most important islands, Sumatra and Java are predominantly volcanic but contain a number of areas of old sedimentary clays, and the north coast of Java and north-east coast of Sumatra are comprised of very deep marine clays of recent origin. These clays are very soft and may extend down to depths of 40 metres or more. It is often possible to push a Dutch penetrometer down to 35 metres without meeting anything hard in these areas. The older sedimentary clays are overconsolidated and often fissured.

The more interesting soils are the residual soils derived from the volcanic materials. Weathering of these materials (andesites, tuffs, sandstones and lahar flows) produces a variety of residual soils, the most common being the red and reddish brown clays known as latasols (lateritic soils). Another important type is a black highly plastic clay belonging to the "black cotton" group frequently encountered in soils literature. The most unusual residual soil is a yellowish brown soil known here as andosol. This is found mostly at higher altitudes and is derived from the weathering of volcanic ash. It is believed to belong to the allophane group and undergoes drastic changes on air or oven drying. It is a remarkably good engineering material despite abnormally high water contents (up to 200%).

Weathering extends down to considerable depths; the red clays are frequently up to 10 metres thick while the yellowish brown andosols may be over 20 metres. These residual soils are all very fine grained with high liquid and plastic limits. The traditional classification of clays and silts into two groups at a liquid limit of 50 is not very useful as almost all the residual soils have liquid limits well above 50. There are in fact many more soils with liquid limits above 100 than there are with liquid limits below 50.

One group of soils which are missing from the soils spectrum are the highly sensitive sedimentary clays such as are found in Europe and North America. Sensitive soils are not common, although the weathered volcanic ashes may sometimes be highly sensitive, as in New Zealand.

The Soils Engineering Field

All in all the soils engineer may rightly regard this country as something of a paradise from the point of view of the interesting soil conditions available. However, the soil mechanics world present a rather depressing picture. The problem is not that soil mechanics isn't yet established - there are numerous soil laboratories in Bandung alone, and soil mechanics forms part of all civil engineering courses at local

universities. The problem is essentially a historical and cultural one which is a little difficult to explain in a few lines. Laurie then lists some specific factors which at least partly account for difficulties he has found in soils engineering work.

Firstly there is the direct cultural factor, an overall concern with prestige and status ("face"). In general Indonesian soil engineers don't like to get their hands dirty, so field investigation work and laboratory testing are left in the hands of junior technician type staff who do the job as best they can with little guidance or supervision from above. The appearance of the final report is often regarded as being more important than the reliability of the data it contains.

A second factor is the content of the education that soil engineers receive at the universities. There is an emphasis on intricate theoretical analysis with less attention being given to basic principles and fundamentals. Students learn such things as the derivation of the formulas for stress distribution in a semi elastic mass beneath a loaded area, but the principle of effective stress is not mentioned. Foundation design is taught in the first and second year and soil mechanics in the third and fourth year. The result is that graduates can leave the university rather confused about soil mechanics.

The third factor which comes to mind is the economic factor. Soil mechanics is very commercialised and is often seen only as a means of making money, rather than as a science. "Commercialisation" of educational and scientific institutes is a general feature of the country at the moment.

Despite the above comments there are a number of very competent engineers in this country but they are almost all found in the structural engineering field. Soils and material engineering seems to be regarded as a second rate occupation and the top engineers are not attracted to this field.

Laurie's Own Work

Laurie is attached to the section of the Public Works Department which handles soil investigations for roads, bridges, buildings etc. It has the rather grandiose title of Institute for Soil Investigations and Highway Research. His job is to help develop the Institute by whatever means he can. "Upgrading" is the in vogue term to describe the sort of activity he is engaged on. His time is divided over three main activities. The first is direct staff training which consists of lecture and practical courses for technician and engineer staff. The Department is in the process of setting up regional laboratories and he has been responsible for staff training on the soils side for these laboratories.

The second activity which has taken up a lot of his time has been literature preparation. This consists of writing and translating such things as testing manuals, design guidebooks, drilling and sampling guidebooks etc. The standard of English is generally poor, so that even many engineer level staff are hardly capable of reading technical English. The technician staff don't normally know any English. So Laurie has attempted to provide something in the way of written material to which they can refer. He learnt Indonesian during his first term in the country as a Volunteer and his work now is carried out entirely in Indonesian.

The third activity is handling particular jobs, and in particular many of the jobs for foreign organisations are given to him to look after. The Institute does not only handle Government work but also all the "outside"

work it can get which is another example of the commercialisation of a scientific institute. However Laurie is quite happy to handle some of this outside work as it is another opportunity for staff training by direct supervision of their field and laboratory work.

Comments on Life and The Country in General

To close, a few comments about life and the country in general may be of interest. Life is pleasant and relaxed (except when travelling on the highways) and the country interesting and fascinating from every angle. Basically, Indonesia is a very attractive country (attractive people, scenery and climate) but population pressure is creating enormous problems, and some aspects of the local scene at present are anything but attractive. Some idea of this country's problems can be gauged from the fact that there are now 25 million more people than there were when Laurie first went there just over 10 years ago. So far little real headway has been made in tackling the country's problems. Local newspapers frequently comment that the gap between rich and poor has widened rapidly over the past few years.

New Zealanders are visiting the country, and working there in various capacities, much more these last few years than when Laurie was first there in the early 1960's. He would certainly encourage anyone who has the opportunity to go there to take it up and make the most of it. In particular engineers going there, whether in a consulting capacity or under aid schemes, should take time off from their "engineering" to learn a little about another culture and another way of life, as well as to appreciate something of the problems the country faces. He has had a very enjoyable time working in association with ENEX personnel on one or two jobs and thinks that ENEX engineers would agree that the experience of being there was worthwhile.

Living there as a family, has presented no real difficulties. His wife likes the place as much as Laurie does and their two school age children are happily settled into local schools. They envy the ease with which their children pick up the language. Their eldest daughter (9 years) is now learning her third language, as they are taught the local West Java language, starting this year. Teaching is normally in the national language Indonesian. They have three children, the third being a girl born in Bandung two years ago.

INVOLVING THE DRILLER IN SOILS INVESTIGATION WORKK.H. Gillespie

With a few notable exceptions private companies providing drilling services for soils investigation work began as water well drilling contractors. Less than twenty years ago it was common to find such investigations being treated as odd jobs to be done if and when there were no wells to be drilled.

However, over the past ten years there has developed a new and generally younger type of driller who tends to specialise in soils investigations. By virtue of their almost continuous exposure to this work, these people have accumulated extensive skills and a wealth of knowledge which an engineer would be foolhardy to ignore. Throughout the country, such drillers are now well equipped with modern custombuilt exploratory rigs and reliable ancilliary equipment.

To obtain the best possible results in any soils investigation the engineer should, at the outset, seek and obtain the full confidence of the driller. As far as permissible, he must prior to commencement of drilling, outline the reasons for the investigation, the type of information required and any data which may have been already obtained on likely subsurface soil conditions. Procedures for sampling and insitu testing should also be discussed. The driller may well be more familiar with their uses and limitations than is the engineer. Only on very rare occasions can the driller be truly and fairly blamed for lack of data or for poor sample recovery. Almost invariably these problems arise because of inadequate pre-job briefing or lack of engineer - driller communication.

As the field work proceeds, the engineer must continue to exhibit interest in what is being achieved. No person could be expected to provide utmost concentration on recovering truly undisturbed and accurate soil samples if he knew or suspected that these were never going to be looked at anyway. It is to the discredit of engineers that drillers can, all too often, complain of their hard-won samples left lying untouched on the site months after completion of drilling.

In these days of technical skill and supposed enlightenment, the driller should not be engaged as a servant of the engineer. Rather he should be a contributing member of a team set up to obtain the best results possible.



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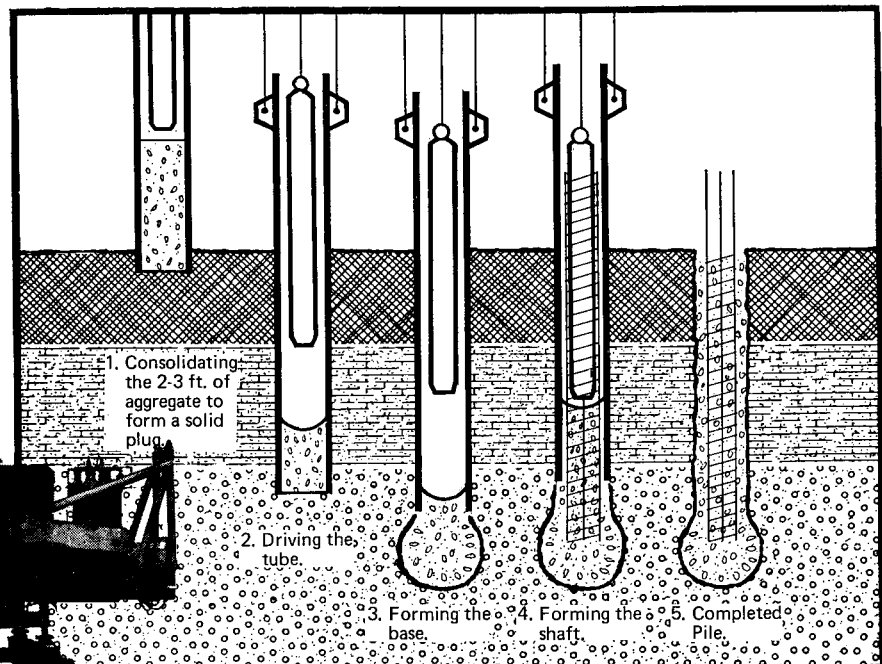
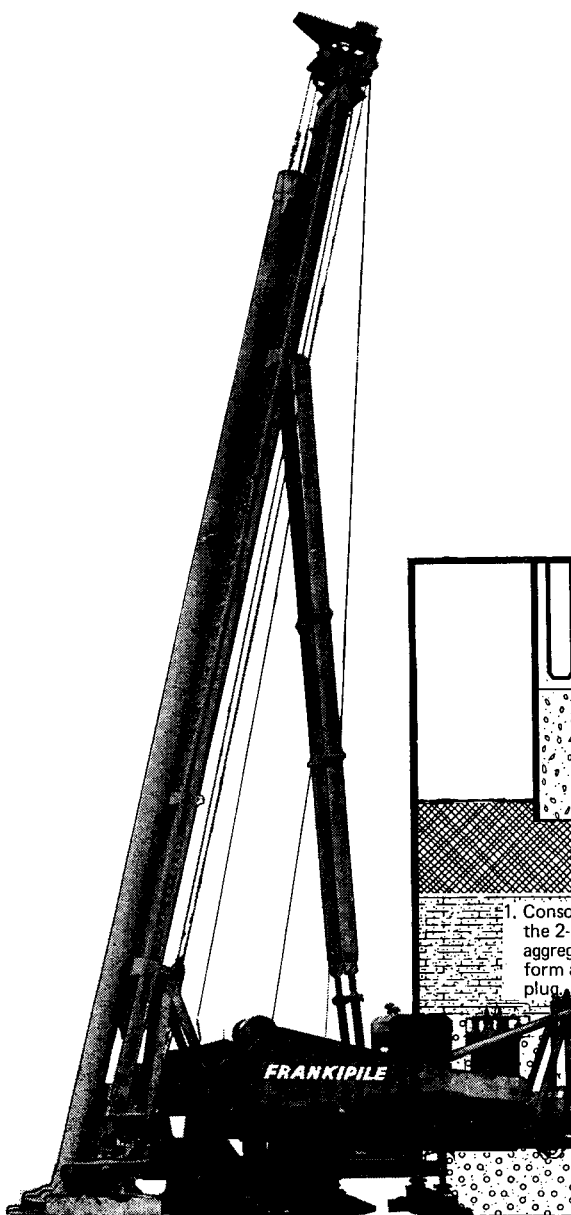
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NEWS FROM THE MANAGEMENT SECRETARY1. New Members

New members elected to the Society since the last list was published in Issue No. 4 (June 1972) are as follows:-

I.R. Brown	:	Christchurch	I.M. Parton	:	Wellington
M.W. Frost	:	Invercargill	B.R. Paterson	:	Turangi
B.L. Gunderson	:	Christchurch	R.W.M. Smith	:	Auckland
C.T. Husband	:	Auckland	G.W. Stonex	:	Auckland
L.O. Kermode	:	Auckland	L.H. Waring	:	Auckland
M. Keys	:	Hastings	L.J. Wylde	:	Australia
G.D. Mansergh	:	Christchurch	P.D. Wilson	:	Wellington
M.T. Mitchell	:	Hamilton			

2. Forthcoming Conference

The 3rd International Congress on Rock Mechanics will be held in Denver, Colorado, U.S.A., during the period 1st to 7th September 1974. All papers from New Zealand are to be submitted through the Society which has been allocated an initial number of three papers. All papers and abstracts are to be in the hands of the Society for review by August 1st, 1973, but it would be most desirable if intending authors were to give prior advice to the Management Secretary. Preliminary Instructions for Preparation of Papers are available from the Secretary.

Attention will be centred on the following major themes:

- I. Physical Properties of Intact Rock and Rock Masses: The characterisation and rational description of the physical and mechanical properties of intact specimens and of rock masses, stressing general applicability. Both static and dynamic loading will be considered.
- II. Tectonophysics: Mechanical, thermal, and related tectonic processes in the earth, and their effects on the behaviour of rock.
- III. Surface Workings: Application of rock mechanics in the analysis and design of foundations, slopes, and other surface structures in rock.
- IV. Underground Openings: The analysis and design of permanent and temporary underground openings in rock.
- V. Fragmentation Systems: Theoretical and applied studies of rock fragmentation and comminution.

Further and more detailed information is available from the Management Secretary. In addition to the week long technical and social programme at the Congress, pre and post congress tours are planned.

3. Membership Application Form

A membership application form is included at the rear of this newsletter. If you show the newsletter to any non-member who expresses interest in joining the Society, please cut out this form and give it to him.

4. 8th International Conference on Soil Mechanics and Foundation Engineering at Moscow, August 1973

- (a) Several members wishing to attend the conference have enquired about procedure for registration, etc. The Society has recently written to the Organising Committee requesting information on this matter, and it is hoped that it will be available soon.
- (b) The Organising Committee has advised that the closing date for written reports to the Specialty Sessions, noted as August 1st 1972 on page 23 of the last issue, has now been extended to December 15th 1972. Copies of the information bulletins are available from the Management Secretary for members wishing to submit reports.

The subject matter of the Specialty Sessions are:

- (i) Equipment for the observation of settlements and stresses in bases
- (ii) Problems of nonlinear soil mechanics
- (iii) Design of earth and rockfill dams
- (iv) Soft soil bases for concrete hydrotechnical structures
- (v) Lateral pressure of clayey soils on structures
- (vi) Stability of slopes of deep excavations and natural slopes
- (vii) Methods of soil stabilisation (chemical, slurry trench construction, etc.)
- (viii) Soil dynamics and seismic effects on foundations.

5. Geotechnical Abstracts

The Management Committee wishes to bring to the attention of all members the potential value to them of the publication "Geotechnical Abstracts" which is published by the German National Society of Soil Mechanics and Foundation Engineering with the authorisation of the International Society for Soil Mechanics and Foundation Engineering and financial support from the Volkswagen Foundation.

The Abstracts have been published monthly since January 1970. Each issue contains 144 abstracts of recently published papers. Two editions are available, one printed on paper and the other printed on cards which are perforated for filing under the International Geotechnical Classification System. Both editions have the same annual subscription rate of DM 126 (approximately \$NZ 30).

Their worth was recognised by the Soil Mechanics and Foundations Division of A.S.C.E. which abandoned its own International Abstracts in favour of these Abstracts.

The value of subscribing to Geotechnical Abstracts would be much more than subscribing to any single technical journal.

Subscriptions should be sent to:-

Deutsche Gesellschaft für Erd-und Grunbau,
35a Kronprinzenstr.,
43 Essen,
Germany.

6. Annual General Meeting

The Annual General Meeting of the Society will be held in February 1973. The time and place will be confirmed in a notice to members which will be sent out in January. It is expected that the meeting will be held in Hamilton during the Annual Conference of the N.Z. Institution of Engineers during the week 19-24 February. The probable time is the evening of Wednesday 21 February 1973.

P.G.M. IMRIE

Management Secretary

N.Z. Geomechanics Society,
P.O. Box 12-241,
Wellington

REPORT ON COURT OF APPEAL DECISIONJ.P. BlakeleyBackground

In "N.Z. Geomechanics News" No. 2 (June 1971) an account was given of a decision made in the Supreme Court at Wellington in March 1971. The case involved the collapse of a brick wall of a service station (erected in 1929) when a contractor excavated a trench in September 1969 immediately adjacent to the wall on the neighbouring property. The trench was being excavated as part of the construction of a new building. The plaintiff (owner of the collapsed wall) sued the contractor for the damage caused to his wall. The plaintiff alleged that the defendant had been negligent in two respects:-

- (a) failing to underpin or provide temporary supports of any nature to counteract the removal of the natural support to the plaintiff's land and brick wall
- (b) excavating in close proximity to the brick wall when he should have known that such excavation could cause the collapse or subsidence of the plaintiff's land and brick wall.

The judgement made was based on a decision in the English House of Lords in 1881 (Dalton v Angus). The supreme court judge found that the evidence established that the soil under the wall was of a poor type and that the load applied to the soil by the weight of the wall caused the subsidence and collapse of the wall. He considered that it was clear but that for the presence of the wall there was no reason for the plaintiff's land to subside. This meant that it was not the excavation of the trench alongside which caused the plaintiff's land to collapse but the presence of the wall on the soil. Also there was no evidence of any trespass and in accordance with the principle laid down in Dalton v Angus it followed that apart from the acquisition of a right to support in some recognised manner (such as by an easement) the plaintiff had no right to the support of the defendant's land. The judge therefore ruled that the collapse was due to the weight of the wall and the plaintiff lost his case. This was in spite of the fact that there was evidence supporting the contention that the defendant had been negligent in digging the trench along the whole length of the brick wall without shoring or timbering the excavation to support the wall, and that another recognised method which could have been used was to dig the trench intermittently so that there was always a certain amount of support left.

Court of Appeal Decision

The hearing in the Court of Appeal was on 22-23 September 1971 and the judgement was delivered on 16 December 1971. The three judges were unanimous in allowing the appeal and thus reversing the Supreme Court decision.

The President of the Court said that in his opinion the defendant did owe a duty to exercise reasonable care for the protection of the plaintiff's wall as he exercised his property right to excavate the soil adjacent to the building. However, it must be recognised that the standard of care required of the adjacent owner must not be fixed at an unreasonable level, and it must not be fixed in a way that would impose on him absolute liability as would be the position if his neighbour had acquired an easement. In short, the adjacent owner's obligation would be to take reasonable care

to avoid damaging his neighbour's building in excavating soil on his own land and in the present case the defendant excavated the soil adjacent to the plaintiff's building in a way which was described by the Judge as a failure to take even elementary precautions to preserve the stability of the wall which supported the building. Accordingly the President said that in his opinion the appeal should be allowed and the case remitted to the Supreme Court for the assessment of damages.

The second judge in his decision said that the case must be looked at from the point of view of common sense. He could not believe that the man in the street could accept the conclusion by Lord Penzance in the *Dalton v Angus* case that it is permissible for an excavator to proceed with his excavation without any regard for his neighbour even to the point of bringing down his building "in ruins to the ground". The man in the street might say that Lord Penzance did not live in the world of building contracting, that he lived in the last century and not in the year 1971 and that in his day there were not buildings twenty or thirty storeys high being built in every city street as a matter of course. The judge said that the man in the street would not agree for a moment with the proposition that in the course of building operations it is permissible for the occupier of a building lot to conduct excavations without any regard to the consequences which may follow to his neighbour's multi-million dollar building next door, or even without any duty to warn the neighbour of the fact that he was about to begin excavating. The judge concluded that those responsible for the conduct of modern building construction must recognise some duty of care resting upon persons excavating their own land up to its boundary. The burden cast upon them may not be great. It must depend upon the current needs of the community and it is possible that at least in some cases it could amount to no more than a duty to warn the neighbour, and perhaps in any case to do no more than to refrain from unnecessarily doing acts endangering his property. But there must be some duty and the law must not be allowed to atrophy through failure to evolve with the times. He therefore agreed with the President that the appeal should be allowed.

The third judge said in his decision that he was clearly of the opinion that irrespective of any right of support, an excavator does owe a legal duty to a neighbouring owner to exercise reasonable care not to cause needless damage to the latter's buildings. At common law one of the natural incidents of the ownership of land is the right to the lateral support naturally provided by the adjoining land. This is an absolute right and if a neighbour excavates so as to cause subsidence he will be liable. But this absolute right has never extended automatically to buildings. They have been regarded as a supervening and non-natural burden upon the soil and disentitled (at least immediately) to the extra degree of support they might require beyond that needed for the bare land. If it were otherwise, property lawyers have claimed that the adjoining owner would be deprived of his rightful freedom to excavate as he pleased subject only to leaving support for his neighbour's bare land; while the neighbour would gain an unjustified advantage by building first. Yet an unbridled exercise of property rights would put every built up area at risk.

The subject matter of the complaint was whether an excavator should be entirely free to choose a harmful method of operating beside a neighbour's building. The rule in *Dalton v Angus* has stood in England for nearly a century and that was a decision of the House of Lords. The third judge said that the responsibility of this Court was to decide cases upon the law as it has been developed and made applicable for contemporary New Zealand needs and conditions and was not bound to follow a decision of the House of Lords. It would be quite inappropriate to do so when the rule in question has been based upon a derivative application of principles that are inapplicable in New Zealand. In his opinion the appeal should be allowed and the case remitted to the Supreme Court to enable the issue of negligence to be determined and the appropriate award of damages to be fixed.

ROCK MECHANICS - THEMES FOR FUTURE SYMPOSIA

The International Society for Rock Mechanics advises that its Commission on Research has prepared the following list of themes for future ISRM symposia:-

A - SPECIFIC PROPERTIES OF ROCK AND ROCK MASS

Jointed rock mass mechanics
 Change of volume during shear deformation
 Anisotropy of rocks and rock mass
 Rock properties as a function of depth
 Chalk and soft rocks
 Limestones
 Percolation through fissured rock mass
 Dynamics of rock blasting

B - GENERAL METHODS OF ROCK MECHANICS

Field instrumentation
 Physical and mathematical models describing rock behaviour
 Correlation between mechanical properties and petrographic data

C - ENGINEERING PROBLEMS

Rock drilling/coring and rock drillability at great depth
 Foundations (of dams)
 Stability of slopes
 Protection against rock falls

Members wishing to suggest other topics for consideration by the commission should write to:-

Prof. P. Habib,
 Comite Francais de Mecanique des Roches
 Laboratoire de Mecanique des Solides de
 L'Ecole Polytechnique
 17, Rue Descartes, Paris 5 eme
FRANCE

J.K. Hill
 Vice-Chairman
 Rock Mechanics Sub-Committee
 N.Z. Geomechanics Society

FORTHCOMING STANDARDS ASSOCIATION OF NEW ZEALAND
PUBLICATIONS

J.P. Blakeley

Provisional New Zealand Standard for Foundations

This Provisional Standard was fully discussed in the previous issue of "New Zealand Geomechanics News" (No. 4). It will be divided into two parts. Part 1 sets out the minimum provisions for investigation and provision for foundations for buildings for which specific design of the foundations is not required and for which the work need not be under the control of a registered engineer. Part 2 sets out basic principles relating to investigation, foundation design and supervision of construction of foundations for all types of buildings and related earthworks. The work under Part 2 is required to be under the control of a registered engineer experienced in this type of work.

The work on this Standard is complete and awaiting final approval prior to printing. It should be available for purchase as a Provisional Standard early in 1973 from the Standards Association of New Zealand, Private Bag, Wellington.

As a Provisional Standard, it will be reviewed after twelve months of actual use, and during this period users will be invited to advise the Standards Association of suggestions for improvement.

Draft New Zealand Standard Code of Practice for Earth Fill
for Residential Development

A draft Code of Practice DZ4431/272 on this subject was available for comment early in 1972. The original closing date for comments was 22 May but this was later extended to 31 July. A large number of comments were received and these were considered by a technical committee of the Standards Association at two meetings in October 1972 and as a result a number of amendments were made to the draft.

The work is now largely complete and it is hoped that this Code of Practice will be available as a Provisional Standard by mid-1973, for review after twelve months of actual use.

This Code of Practice will be a means of compliance with a bylaw which will be an amendment to N.Z.S.S. 1900 Chapter 3. A draft bylaw DZ1900.3/271 was drawn up by the same technical committee and has since been amended as a result of the comments received.

Draft New Zealand Standard on Methods of Testing Soils
for Civil Engineering Purposes

The technical committee of the Standards Association which will consider this matter has now held its first meeting and members of the committee have been assigned specific tasks. When these tasks are completed, a second meeting will be called, probably during November 1972.

It is expected that the Standard will be based on B.S. 1377:1967 but with some modifications made for New Zealand conditions.

Draft New Zealand Standard on Methods of Test for
Stabilized Soils

A technical committee of the Standards Association to consider this matter has been formed, but the first meeting is being delayed until the draft New Zealand Standard on Methods of Testing Soils referred to above is further advanced.

It is expected that the Standard will be based on B.S. 1924:1967 with modifications made for New Zealand Conditions.

MEASUREMENT OF IN-SITU SOIL DENSITY

(No. 4 in a Series)

J.H.H. Galloway4. DENSOMETER

This article discusses the use of one particular type of balloon volume measuring device. This device is a New Zealand development of an overseas idea and is the only one of these balloon devices that, in the author's opinion, is of merit in routine work.

In balloon type volume meters a thin, flexible membrane is used to line the test hole which is then filled with a convenient measuring fluid, usually water. The devices range from simple membranes draped over the test hole and digging plate and then filled with water to rather sophisticated closed system devices in which the measuring fluid is transferred from a measuring vessel into a balloon in the test hole. The former method suffers from all the uncertainties of ground surface shape (see previous articles) and considerable uncertainties regarding how well the membrane fits the surface of the hole and how much membrane is in the hole. Its use is not recommended except in the case of very large holes (several cubic yards) in coarse fills where no other method is practicable. In the latter method only the fit of the membrane in the hole is involved, the other errors being eliminated by the closed nature of the measuring system. In the best of these devices even the effect of membrane fit is largely eliminated. This device is the New Zealand Densometer, which, incidentally has recently been adopted by the Australian Standards Association as a standard test procedure.

The N.Z. Densometer was developed from the Washington Dens-O-Meter of the Washington State Highways Commission of U.S.A. Though superficially similar they are fundamentally different in principle. The Washington device attempts to eliminate membrane-fit-in-hole errors by using a rather high working pressure (several p.s.i.) while the N.Z. device compensates for these errors by difference and works at very low pressures (under one half p.s.i.). When operated in the recommended manner (three replicate readings in each of three balloon positions) it demonstrates the constancy of the fit errors and since they appear in both sides of the equation eliminates them (one hopes!).

The prime advantage of both types of densometer is that they measure the initial ground surface, thus eliminating one of the largest sources of error. This facility makes it practicable to use the devices to provide a continuous density profile to any desired depth and since, in the process, differences only are used errors are not carried forward. It also means that careful smoothing of the ground surface at the test site is unnecessary, though one must always remember that the digging plate is the datum of the system and must never be disturbed between "initial" and "final" readings.

The Washington device relies on a rather high pressure to expand the balloon to fit into all the irregularities of the test hole. Tests suggest that, except in extremely rough holes, just as good results are obtained by using a larger balloon and a smaller pressure i.e. the N.Z. principle. As the lower pressure has other major advantages it is felt to be the better. These advantages are that the risk of enlarging the test hole is reduced (even a few p.s.i. has a marked effect in clean sands and soft clays) and that the densometer need not be heavily weighted to resist the hydraulic uplift. This weight can cause the digging plate to settle so destroying the basis of comparison. Where the material will not be affected by either of these things higher pressure can still be used in the

N.Z. densometer with an improvement in accuracy in very rough holes (e.g. simulating material of 3" max. size and 70% gravel sizes).

Without an accepted standard of volume measurement in real soils it is difficult to state the accuracy of the device. Laboratory tests in simulated soils, where fluid replacement techniques can be applied with a good degree of control, suggest a slight tendency to undermeasure volumes. For very small holes this is significant but for normal sized holes drops to a few parts per thousand. These accuracies are only obtained when the device is used intelligently on the N.Z. "Comparator" principle. So it is important to ensure that the gauge rings are properly used to ensure that the "initial" and "final" readings are as close together as possible and that the operator watches for any of the signs of misbehaviour discussed in the recommended test procedures.

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