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Rūaumoko: More than just a symbol

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ABSTRACT

The historical stories of Rūaumoko, the Māori god of earthquake, volcanic, and geothermal activity are explored herein to acknowledge and respect the origin of the NZSEE's Rūaumoko logo. These stories were passed-down through many generations in Māori communities (the indigenous peoples of Aotearoa New Zealand) and have become an influential mechanism for the way that Māori approach engineering for natural hazards and natural resources, and for the way that Māori perceive the impacts of such engineering practice on the environment, on their history, and on traditional Māori practice and design. The intent of the reported study was to place earthquake engineering in a te-ao-Māori (Māori worldview) setting, with suggestions provided for reasons why currently there is significant potential for tension to develop between Māori and non-Māori peoples who venture into earthquake engineering projects. It is suggested that a more robust engagement method is needed in the earthquake engineering profession to remedy the potential tension between these two groups. The undertaking of earthquake assessments on marae (the cultural buildings of Māori), and the subsequent retrofitting of marae buildings under new legislation (Building (Earthquake-prone building) Amendment Act 2016) is reviewed, where some earthquake engineers are rightly met with indigenous opposition due to concern that the westernised approach of engineering may damage their valued heritage buildings, and the cultural links to their history.

1 INTRODUCTION

The earthquake engineering profession is currently one of standards and guidelines that prescribe procedures that are rarely strayed from by those practicing it. Structural earthquake engineering primarily entails constructing or retrofitting buildings using strictly prescribed calculations to achieve earthquake resilient buildings, because the failure of an earthquake prone building could potentially mean the death of its occupants. As noble as these diligent earthquake engineers are, there are still improvements to be made when this exercise is placed in an indigenous setting and the earthquake engineer, who often comes from a non-indigenous or westernised background, is required to engage with indigenous peoples. Several groups of Māori (the indigenous people of Aotearoa New Zealand) who attended multiple geothermal wānanga, an

earthquake wānanga, and council hui (meetings) in Rotorua during 2018 identified a general lack of early, meaningful, and mutually understood engagement between engineers and Māori as being the primary cause of many disputes by Māori towards engineering development projects. This poor engagement dynamic is often due to Māori having little knowledge of the factors and calculations considered by earthquake engineers. Conversely, many earthquake engineers have little knowledge of the cultural values held by Māori and therefore tend to be oblivious to the consequences that their standardised engineering practice has on those Māori cultural values.

Earthquake engineers are likely to receive more trusting responses by Māori to engineering development proposals if they first acquire and demonstrate an insight and awareness of Māori cultural values such as wāhi tapu (sacred places), the cultural benefits of natural resources, protocol around natural disaster responses, meeting with Māori and being welcomed on to marae, and the importance of intangible connections that Māori develop with their environment and their ancestors. Consequently, acquiring a comprehension of such Māori cultural values will allow earthquake engineers to possess the knowledge, the connections, and then the capacity to incorporate a mātauranga Māori¹ based decision-making regime that is founded on the way that Māori view and approach engineering decisions and development for natural hazards and natural resources.

According to Māori mythology, Rūaumoko is the god of earthquakes and thus sets the foundation for most cultural values, beliefs, and influences on decision-making practices regarding earthquake hazards (Kahukiwa, 2017). Therefore; earthquake engineers working in Aotearoa will find benefit in learning about Rūaumoko, where they may be able to share an understanding of the underlying values held by Māori to ensure that there is mutual respect incorporated into earthquake engineering engagement and works.

1.1 Research methodology

Two of the authors are of Māori and Pasifika descent, who remain immersed in their cultures, values and languages. As such, there is knowledge within this research that comes from the lived experiences of the authors. The research methods adopted in this study were conducted in accordance with tikanga Māori (Māori lore), and the well-established kaupapa Māori methodology – research by Māori, for Māori and with Māori, using an actioned based participatory research method. Wānanga and pōwhiri (traditional style meeting and discussions) replaced workshops, and korero kanohi-ki-te-kanohi (face to face talk at home) replaced interviews. The wānanga were held at marae, and kōrero were had at kainga (homes), where our informants felt most comfortable to discuss the deep and sensitive knowledge pertaining to Māori culture, histories and stories of Māori land, lore, and the influences from which Māori cultural values arise. Other parts of the knowledge expressed herein come from the memoirs, excerpts, manuscripts and published materials of Māori experts and historians, such as Te Hiko-o-te-Rangi Hohepa, Paora Maxwell, Evelyn Stokes and Don Stafford.

2 STORIES FROM MĀORI HISTORY

Note that the contents in Māori stories are not consistent across the beliefs of all Māori. Clear differences in story variations occur between different iwi (tribes), but significant differences are also evident within a single iwi by way of hapū (sub-tribe/s) bias. Hapū tend to demonstrate bias towards story versions that favour the ancestor from whom they are descended. For example, the people of Ngāti Tūwharetoa (Tūwharetoa sub-tribe), who are descendants of Ngatoroirangi, might believe that the great race between the legends, Ngatoroirangi and Tia, ended with Ngatoroirangi arriving at Taupō first to claim the land, while

¹ mātauranga Māori refers to 'the knowledge, comprehension, or understanding of everything visible and invisible existing in the universe as perceived by Māori

those of Ngāti Pīkiao, who are descendants of Tia, might believe that it was Tia who arrived at Taupō first (R. Manuel, personal communication, June 20, 2018). Generational variations also exist due to book authors expressing the stories perhaps in a more age appropriate way for children's books, or perhaps to simply make the stories more exciting (T. Fox, personal communication, June 20, 2018). Regardless of the variations, these stories inform Māori about the origins of humanity, of their whanau (family), and of their connection to their whenua (land) and are therefore a dominant influence on Māori values. It is widely accepted among all Māori that none of the variations are wrong and that all of them are correct. The discussion herein attempts to exclude the finer details of these stories to avoid bias of information. Note however that the first author's background being of Te Ārawa descent might reveal some bias for literature from Te Ārawa peoples.

2.1 How the world was created and how life began

The creation of life began with Te Kore (the nothingness), Te Pō (the darkness), and Te Ao Mārama (the light). Together they created the gods Ranginui, the sky father, and Papatūanuku, the earth mother (Keane, 2011). Ranginui and Papatūanuku had nine sons – the eldest is Tāne Māhuta, the god of forests and protector of all plant life and terrestrial animals. Tāwhirimātea is the god of wind and storms. Tangaroa is the god of the ocean and protector of all aquatic life. Tūmatauenga is the god of war, while Rongo-mā-Rāeroa is the god of peace, and together these two keep balance within human relationships. Rongo-mā-Tāne is the god of kumara and all cultivated foods, while Haumia-Tiketike is the god of wild foods. Whiro is the god of darkness. And finally, Rūaumoko, the youngest child of Ranginui and Papatūanuku, is the god of earthquakes, volcanoes and all heat that comes from within the ground (Best, 1976).

The children of Ranginui and Papatūanuku lived in between their parents, where no light was able to enter the confinement that Ranginui and Papatūanuku had created by being so close to each other. The children grew frustrated with living in constant darkness, and because of their desire to see the light, Tāne Māhuta, the god of forests, separated Ranginui and Papatūanuku to allow the light from Tama-Nui-te-Rā (the sun) to flood into the world, bringing forth life. Tāwhirimātea, the god of wind, Tūmatauenga, the god of war, and Rongo-mā-Tāne, the god of peace stayed with their father, while the others remained on the ground with their mother (Best, 1982).

2.2 Rūaumoko: the god of earthquakes, volcanoes, and geothermal activity.

When the parents Ranginui and Papatūanuku were separated, the youngest child, Rūaumoko was yet to be born and thus was still in Papatūanuku's womb. He has remained in the womb of his mother since that time. The shaking of the lands is a result of Rūaumoko kicking and moving around, volcanic eruptions are the cause of his mother's pregnancy illnesses, and underground heat and geothermal surface features are the result of his mother's varying body temperatures. Although Rūaumoko is only an unborn child, Māori believe that he is very powerful and non-forgiving. It is believed that when his mother is harmed by humans, he will respond with great force by breaking the ground and flattening structures (Waikerepuru, 2012).

Stokes (2000) describes the origin story of Rūaumoko differently from that told above. Following the separation of their parents, the children turned their mother Papatūanuku facedown towards Rarohenga, the underworld, so that Ranginui and Papatūanuku could not witness each other's sorrows. Rūaumoko was at that time a child still at the breast of his mother. As such, the older brothers of Rūaumoko decided that he would be left to live in the underworld as a comfort for his mother. To keep their mother and their youngest brother warm, the children gave them volcanic fire known as Te Ahi Kōmau (the first fire).

Great battles emerged between the brothers who resided above land, and after his defeat Whiro descended to Rarohenga, the dwelling place of Rūaumoko. The thought grew in Whiro that he and Rūaumoko should have but one object in common to avenge the ill treatment of their mother and their father. Rūaumoko consented to this proposition, and then Whiro proposed that they should operate above in the Ao-tu-roa (the world

above) and make war on the older brothers, whereby Rūaumoko replied to Whiro “Ye are all from above; carry on your warfare above. I am from below, and here I will engender my warfare using the very fire that was gifted to me, Te Ahi Kōmau”. Hence through Rūaumoko, earthquakes, volcanoes, and geothermal phenomena are constantly warring against us in his efforts towards revenge on his brothers (Stokes, 2000).

The differences in the above story versions are evident, with one version telling the positive story of a woman undergoing the natural processes of pregnancy, and the other version telling a darker story of the conflict within a family. Nonetheless, overwhelming similarities exist even between tribes on opposite sides of the country, whereby one can conclude that in ancient times, Māori correctly understood the connectedness between the instabilities of the ground, the pressure build-up of magma underneath the crust, and the heat source from which geothermal features are created. Maxwell (1990) noted in his report for the Waitangi Tribunal, that ancient Māori could predict volcanic or earthquake events by living amongst and observing unrest in the geothermal systems by understanding the connectedness between adjacent geothermal features and the surrounding terrain. Geothermal unrest was considered the first sign that Rūaumoko was unhappy with people and is the reason why Māori see fit to protect and sustain geothermal resources with great ferocity, and why causing damage to geothermal systems is considered the first step towards causing natural disaster by earthquake or volcanic eruptions.

2.3 The gifts, and the punishments from the gods

The Māori gods are credited with providing humankind with all the natural resources that we extract, develop, and manipulate to our own benefit. Tāne Māhuta provides wood to build homes, and Haumia-Tiketike provides animals to hunt for. Tāwhirimātea provides air to breath and wind to push sails and windmills. Tangaroa provides delicacies from the sea and keeps the earth’s atmosphere cool. Rūaumoko provides geothermal resources that have and continue to keep people and homes warm and provide a source for electricity. However, it is well known that if these gifts are not respected then there are major consequences such as hurricane, a tsunami, a volcano, or an earthquake. These examples are but a few of the ways that the gods can punish humanity (Hohepa-Watene, 2016). Māori believe that the Tarawera eruption in 1886 was caused by disrespect towards landscapes and landmarks such as the once famous Pink and White Terraces, with people having been seen etching their names into the sacred geothermal stone, or even breaking off pieces of stone and taking them. Then Rūaumoko saw fit to destroy the terraces with the Tarawera eruption (Maxwell, 1990).

Māori have personified the various forces of Rūaumoko. These personifications are the maids or daughters of Rūaumoko who deliver the punishment from Rūaumoko’s dwelling underground, to the world above. Hine-Puia brings volcanic eruption, Hine-Tuoi brings earthquakes, Hine-tuarangaranga brings cracking of the land and landslides, Ioiowhenua brings hardness to the ground, and Te Hōata and Te Pūpū bring heat to the earth’s surface, and to surface and underground waters (Stokes, 2000).

3 FROM RŪAUMOKO TO OUR ANCESTORS

3.1 Exploits of our tīpuna (ancestors), and stories of our lands.

As direct descendants of the Māori gods and historically recognised as very large and tall people with extraordinary abilities, the tīpuna Māori (ancient Māori ancestors) were given the responsibility of informing humans of the desires of the gods, and guiding humans on the path that the gods intended for them (Hohepa-Watene, 2016). Tīpuna communicated to the gods through karakia (prayer) requesting the gift of natural resources needed to develop human existence (Kahukiwa, 2017).

Māori believe that the exploits of tīpuna brought the gods’ natural resources to their lands. Many famous stories exist within te-ao-Māori (Māori worldview) that depict the travels and exploits of tīpuna that caused

natural phenomena to occur on Māori lands. The demigod Maui is the most well-known tīpuna among Māori and Pasifika. Maui is well-represented in children's books, where he is responsible for many of the resources that humans have today. Māori children and many Pākehā (non-Māori) children are told the stories of how Maui slowed-down the sun to lengthen days, how he stole fire from the goddess of fire, Mahuika, and brought it back to the people to burn wood and provide them with light, or how he fished up the Te Ika a Maui (the North Island of New Zealand) from his waka (canoe), named Te Waka ā Maui (the South Island) (Gossage, 2016). The actions of tīpuna such as those of Maui have given Māori a deep appreciation for how fortunate the people are to have such resources at their disposal, such as the longer days of summer to cherish and spend with family, the fire that was stolen for humans to enjoy and therefore be treasured in respect of the fire goddess Mahuika, and finally, the land of Aotearoa, a giant whai (stingray) who gave its life so that Māori can call it their home.

Another famous ancestor is Ngātoroirangi, a priest who arrived to the shores of Maketū, New Zealand on the Te Ārawa waka (the tribal boat for which all Te Ārawa iwi people are descended from its voyaging party) captained by Tamatekapua. Ngātoroirangi's exploits are vital to understanding the value that Māori place on geothermal resources gifted by Rūaumoko. Ngatoroirangi and his sisters Kuiwai and Haungaroa are credited with delivering the abundance of geothermal, earthquake and volcanic activity to the Te Puku o te Ika (Bay of Plenty) and the Waikato regions (Delani Brown, 2005).

3.2 Pēpeha (the land of origin of Māori), Tūrangawaewae (a place to call home), and Whakapapa (genealogy).

Ko Te Ārawa me Tainui nga waka

Ko Te Ārawa me Tainui nga iwi

Ko Whakapoungākau me Maungatautari nga maunga

Ko Te Rotorua-nui-a-Kahumatamomoe te roto, ko Waikato te awa

Ko Ruamata me Maungatautari nga marae

Ko Ngāti Uenukukōpako, Ngāti Te Roro-o-te-rangi, me Ngāti Rangiteaorere nga hapū

Ko Ngāti Koroki-kahukura te hapū

Ko Tamatekapua raua ko Kingi Koroki nga tīpuna

Ko Nona Hohepa-Taute ahau

The above pēpeha is that of the first author and draws on the origins of both his father's family and his mother's family.

Whakapapa is the Māori term for genealogy and most indigenous peoples around the world will use whakapapa to identify their connection to the original iwi (tribe) from which they are descended. Within whakapapa lies the concept of pēpeha, which is a knowledge system that enables Māori to realise their connection not only to their ancestors and iwi, but to their geographical origin or their Tūrangawaewae (a place to stand) as well, being the environment from which they and their wider family come from and can consider as their home, thereby connecting Māori to both people and place (Hohepa-Watene, 2016).

A kaumātua (a Māori elder) will often hear ones pēpeha and immediately make the connections between their two whānau (families). Te Hiko-o-te-rangi Hohepa, an expert at whakapapa from Te Ārawa, was exceptional at making connections. He travelled around New Zealand and to many countries, studying lineage as far back as he could go. Eventually, many people (both Māori and others from around the world

alike) would seek his advice to learn of their connections to ancient indigenous peoples and to others from across the world. Hiko Hohepa of the Te Ārawa iwi knew the sacredness of lineage, where he emphasised that its sacredness originated from the gods, being the creators of life and the providers of natural resources. Thus, the connection is realised, where humans must respect the memories of their ancestors to respect the legacy of the gods, consequently acknowledging the origins of their environment and all its resources. Hiko Hohepa, who died in 1998, is the Koro (grandfather) of the first author.

3.3 Māori values

Māori values are often intangible and qualitative in nature, and therefore non-indigenous people might find them difficult to comprehend (Hikuroa, Slade, & Gravley, 2011). Understanding Māori values requires knowledge of Māori lore and Māori history. However, further understanding of Māori values requires the realisation that whakapapa is not merely an idea, but rather a living construct in te-ao-Māori. Such a realisation allows one to appreciate the values that originate from the connection that Māori have with their land, their gods, and their ancestors.

4 MĀTAURANGA MĀORI DECISION-MAKING IN EARTHQUAKE ENGINEERING

At the core of any engineering practice are the decisions being made at the beginning and in the background of the design and execution phases. For earthquake engineering practice to be well-received and trusted by Māori when placed in a culturally sensitive setting, mātauranga Māori must be understood and embraced by the engineers, not in the later parts of a project when engineers are required to consult with Māori, but in the early conceptual and decision-making stages of a project (L. Kereopa, personal communication, September 19, 2018). This requirement prompts the idea of a mātauranga Māori based decision-making regime within New Zealand's earthquake engineering community. This recommendation does not require that earthquake engineers replace their current considerations and mindsets learnt while gaining their university degrees, but rather that the recommendation suggests that earthquake engineers expand their considerations to include those of mātauranga Māori.

Mātauranga Māori decision-making is a concept that is founded by basing one's decision-making principals on a lived and understood experience with Māori cultural practice, values, history, and a holistic mindset (K. Morgan, personal communication, June 20, 2018). Most engineers in Aotearoa are non-indigenous (Stats New Zealand, 2013) and therefore, the lived and understood experiences required in mātauranga Māori decision-making are often non-existent. Furthermore, many engineers who are of Māori descent often do not entirely possess the knowledge to practice mātauranga Māori decision-making themselves. Mātauranga Māori decision-making is therefore achieved by drawing on the experiences of others (Māori representatives). Such Māori representatives should be those who have and continue to experience first-hand Māori cultural practice and traditions, are prominent, well-known, and well respected within the community, and have knowledge of the local stories, art forms and community whakapapa (genealogy on a communal or tribal scale).

Mātauranga Māori decision-making requires comprehensive engagement with Māori, and where appropriate but not necessarily required, the wider community as well. The holistic nature of Māori lore means that decisions are based not only on the word of Māori representatives, but also on the word of diverse perspectives beyond Māori culture (T. Fa'au, personal communication, June 20, 2018).

An example of mātauranga Māori decision-making is recognised in the practice of earthworks while considering the possibility of buried Māori artefacts, historically significant rivers and streams, wāhi tapū, and any other factors that may be of significance to Māori (P. State, personal communication, September 19, 2018). Further examples of mātauranga Māori decision-making are recognised where architectural, building, and retrofitting decisions consider appropriate representation of the local Māori design styles, languages or

dialect, and ancestral stories. Such examples may be seen where Māori have an interest in the design and function of a facility, such as a library, a school, a university faculty, a museum, an airport, a hospital or a marae. Mātauranga Māori decision-making in the earthquake engineering community is essentially practiced by acting under the advice and wisdom of Māori representatives to account for the considerations founded by Rūaumoko and to preserve and acknowledging his legacy as the creator and the god of earthquakes.

5 A MĀTAURANGA MĀORI APPROACH VS A WESTERN APPROACH

Many western policies in the engineering profession, such as the Resource Management Act 1991 (RMA), now involve mandatory engagement with Māori and an element of respect and consideration for Māori values where applicable (Palmer, 2015). However, for an engineer to simply comply with the tikanga Māori policies in the RMA or other relevant legislation, is not considered a mātauranga Māori approach. Such a “minimum standard” approach tends to be one of ingenuine compliance rather than a genuine Māori-Pākehā partnership approach envisioned in mātauranga Māori decision-making. Real-life cases are explored herein to compare appropriate mātauranga Māori decision-making approaches against a western approach that follows, to the capacity necessary, the tikanga Māori policies in relevant legislation.

5.1 Mātauranga Māori approach by Apa Architects: design and construction for marae

Apa Architects sets a relatively good example of design and construction with a focus on Māori values and engagement. The architectural firm has developed an affinity with marae architecture which draws on the spiritual needs of the marae whānau (marae community). Apa Architects has designed and managed the construction of many marae buildings across New Zealand, including an award-winning building at Tanatana Marae, which was commended by Māori television’s Te Kaea news show (Harunani, 2016).

Aladina Harunani, the Director and Chief Architect of Apa Architects describes the firm’s name:

“Apa” in Māori means fold, layer or spiritual being. We partner with clients as a fold, reflecting positive outcomes. We partner with builders and other consultants as a layer, reflecting help towards each other. We partner with the end users as spiritual beings, to create better spaces and living environments.

In an interview with Māori TV regarding the award winning Tanatana Marae building design, Aladina Harunani explained:

“My first word was to them, would you want something nice, would you want something that would celebrate your culture and your values? How can we do that?”

However there are members of the community, and due to its exposure on the internet, the wider public as well, who might say that the building is over bearing (D. Brown, personal communication, October 21, 2018) and perhaps a waste of money. This is a rather subjective argument.

5.2 Mātauranga Māori approach by Te Ahi O Maui geothermal power station

Geothermal power stations have a reputation of being relatively destructive to Māori communities, their land, and their values (Maxwell, 1990). However, an example contradicting this destructive trend is that of the Te Ahi O Maui geothermal power station. The station was built in a very culturally significant area of Kawerau, New Zealand. As such, the project’s management team strived to preserve the areas’ Māori values in the entirety of the station’s construction and intends to operate the station in accordance with tikanga Māori restrictions through its life-span. Colleen Skerrett-White and Tomairangi Fox of Ngāti Tuwharetoa are on the management team for the station and oversee all actions which may have an impact on the cultural sites of the area. Before and during the construction of the station, Colleen and Tomairangi gave cultural inductions to all staff, contractors, and visitors to ensure that all who entered the site understood its history and its cultural significance. The cultural inductions allowed a cultural perspective to reflect across the entire project

management team including owners, engineers, and contractors, which in turn, resulted in minimal conflict between Māori and non-Māori throughout the execution of the project, and resulted in minimal impact on Māori values such as wāhi tapū and the spiritual connections held at those wāhi tapū (C. Skerrett-White, personal communication, September 19, 2018).

5.3 Minimum standard practice

Since the inception of the RMA, the number of cases that proved destructive towards Māori communities have declined favourably. The decline is due to the policies within the RMA that reinforce the need to consider tikanga Māori in any project with the aim of working with natural hazards or using natural resources (Boast, 1995). Before the RMA, there were Acts in place that allowed large companies such as Tasman Pulp and Paper Mill to confiscate land in Kawerau and dump hundreds of tonnes of waste on it, completely denigrating a once thriving geothermal environment (Hikuroa et al., 2011). Although the RMA is a large step in the right direction, its policies do not enforce a full mātauranga Māori approach. Projects which follow tikanga Māori, but to the minimum extent as specified by the RMA, are considered bad examples of mātauranga Māori approaches. Such projects are exemplified below.

5.3.1 Rotorua Eastern Arterial project

Rotorua is known as the Māori capital of New Zealand, and as expected there is a profound Māori heritage, with its local population extremely defensive against urban development that threatens Māori culture. Rotorua's dense Māori population, Māori land, geothermal active areas, lakes, marae and urupā make any development in the area very culturally complex. This complexity was evident in the New Zealand Transport Agency project for the Proposed Rotorua Eastern Arterial 4 Lane Highway Bypass.

The Rotorua Eastern Arterial (REA) project was formerly a New Zealand Transport agency (NZTA) infrastructure project that had been accepted as the preferred option for a link between the Rotorua central business district and the Rotorua Regional Airport. The proposed highway would have serious effects on culturally significant areas in the region. A proposed mitigation for the destruction of local sacred sites was to swap such sites for other ones of cultural value owned by the council. As stated by NZTA regional director Harry Wills:

“We actually own lands that have significant urupā (graveyards) that won't be needed by this designation that we want to swap as mitigation” (Wilson, 2013).

These comments demonstrated a significant lack of cultural understanding, consideration, and advice sought from Māori. Multiple protests and marches resulted, where in the end, there was insufficient communal support to go ahead with the project (Martin, 2016). Perhaps if the design phase of the arterial highway had been conducted with a high degree of engagement with the community then a more culturally appropriate arterial route, or rather a route less intrusive to cultural sites, would have been determined with the same economic benefits, thus resulting in more positive community support.

5.3.2 Marae retrofit

There have already been cases of marae retrofitting where the communities of such marae are unhappy with what has been done to their home. In a workshop held in Rotorua as part of this study, Waaka (personal communication, June 20, 2018) described how a retrofit done on his marae is very ugly and intrusive to the layout of the whareniui (meeting house) and wharekai (eating house). He described that the steel beams detract from the visual beauty of the old wooden members and the carvings. It is unsure how the engagement process that led to this retrofit design took place, but it is certain that it was not approved by a majority of the community. The Māori who were engaged were the board members of the marae – a very select few from the community. As such, the process was considered to be validated by the marae and by the engineers (J. Waaka, personal communication, June 20, 2018). The events within this marae retrofit are not consistent

with those envisioned in a mātauranga Māori approach because the approval of a select few, regardless of their authority, is not the approval of the marae whanau (marae community) and is not consistent with the inclusiveness of Māori lore. Although it is very difficult for engineers to be inclusive and embrace mātauranga Māori when the board members of a marae are not willing to include the entirety of their whanau in decision-making, the engineers involved could have taken it upon themselves to better understand the significance of a marae and the general values around marae design, thus proactively conducting work in favour of the wider marae whānau, while meeting, or even perhaps surpassing the expectations of the marae board members.

6 EARTHQUAKE PRONE MĀORI BUILDINGS

Western methods of earthquake strengthening are well documented and structural engineers are trained in the application of these techniques. In comparison, Māori have co-existed alongside the forces of Rūaumoko, and over many centuries have developed their own techniques to enhance building, cultural, and community resilience to earthquakes (McSaveney, 2017). Currently there is no recognised western design methodology that facilitates the incorporation of these indigenous techniques into accepted seismic strengthening practice. As such, when earthquake engineers impose their methodologies in indigenous settings, conflicts will almost certainly arise, and repercussions to indigenous ideologies will be felt. Western methods and indigenous methods are likely to clash even more so than in previous times, due to the recent release of new legislation (Building (Earthquake-prone Buildings) Amendment Act 2016), which has effectively increased the minimum earthquake resilience standard of all buildings in New Zealand. This Act also prompts structural integrity screening on marae and other Māori owned buildings, which have a high probability of being earthquake prone. A discussion is to be had on the possible impacts that the screening process and possible subsequent retrofitting process will have on marae buildings, and thus the cultural and historical values that come with them. It is hoped that the following descriptions of marae will promulgate a greater awareness of Māori values and traditions associated with marae to structural engineers, architects, and other key decision makers so that in the future, marae buildings can be made more earthquake resilient in a manner that recognises the cultural values, architectural integrity, and heritage of these buildings.

Marae are the physical manifestation of Ngā Taonga Tuku Iho (ancestral legacy), cultural values, and the Māori worldview. Māori architecture, by design, form, and function, define the tenets of resilience. Maraе, and the wharenuī (meeting houses) within them are enduring, singularly unique, and encoded with cultural memory, but are also exemplars of innovation. They are structures that embody centuries of knowledge and experience of Māori builders, building practices, and technologies expressed and perfected in response to matters of resilience (Hoskins, 2011). They have very strong links to the relative histories of the tribes within which they are situated, and are very spiritual places, often the place where Māori feel closest to their deceased loved ones and ancestors (J. Schuster, personal communication, June 20, 2018). These are some of the many sensitive factors to consider in trying to preserve marae building designs, cultural aesthetics and thus their historical links and spirituality. All such factors need to be rigorously communicated with marae whanau and under the influence of a mātauranga Māori mind-set.

7 CONCLUSION

There are multiple avenues in which the NZSEE should further realise the sensitivities in their relationship with Māori communities. Although Māori artforms are beautiful and are a great way to represent the Māori culture, they possess deeper meanings that describe the history of Māori culture and justification for Māori values and cultural practice. As such, realising the NZSEE's relationship with Māori goes beyond the use of a Māori symbol as their logo, and integrating NZSEE practice with Māori cultural practice has benefits that are just as rewarding as new scientific breakthroughs. In essence, Rūaumoko offers much more to the

NZSEE than just a logo. Rūaumoko is at the core of Māori understanding of earthquakes, and therefore offers the NZSEE the deeper meanings behind the seismic knowledge known by Māori, allowing the NZSEE to understand the origins of the values verbalised by Māori in the engagement processes. Demonstrating the NZSEE's willingness to embrace Rūaumoko's identity brings the institution closer to the indigenous people of the very country in which it is established, and creates a space of mutual respect between them.

The inception of the RMA was a step in the right direction for the protection of natural resources and the interests of Māori associated with natural hazards. However, a more genuine and complete engagement with Māori is envisioned through mātauranga Māori decision-making. Mātauranga Māori decision-making is translatable across all fields of engineering and has great potential to enhance the capabilities of the earthquake engineering profession in their efforts to assist Māori communities to become more earthquake resilient.

Rūaumoko is the Māori god of earthquake, volcanic and geothermal forces, and thus possesses influence over the way that Māori think about the repercussions of theirs and others' actions in natural hazards and natural resource management, landscape, and construction. The idea of whakapapa is incumbent in the Māori origins and the stories of the Māori gods, the people, their lands and their ancestors. Thus, whakapapa provides a description of how all Māori are spiritually connected to their ancestors, which sets the foundation for all spiritual values held by Māori. Māori landmarks, wāhi tapū and particularly marae, are all physical manifestations of Māori ancestors and thus are places where Māori feel closer to their ancestors. Consequently, the preservation of such places is vital in respecting the memory of Māori ancestors and upholding the legacy of Rūaumoko.

It is hoped that the knowledge presented herein will promulgate to earthquake engineers, not only the understanding of the values held by Māori, but the realisation of how significant such values are to Māori communities and how beneficial such values are to the wider New Zealand community and economy. Earthquake engineers should strive for a mind-set in which they genuinely want to conduct marae retrofit work under the desires and benefit of the marae whānau, as well as strive to gain the ability to do so.

8 REFERENCES

- Best, E. 1976. *An account of the cosmogony, anthropology, religious beliefs and rites, magic and folk lore of the Maori folk of New Zealand part 1*. Wellington, New Zealand: Government printer.
- Best, E. 1982. *An account of the cosmogony, anthropology, religious beliefs and rites, magic and folk lore of the Maori folk of New Zealand part 2*. Wellington, New Zealand: Government printer.
- Boast, R. 1995. Geothermal resources in New Zealand: A legal history, *Canterbury Law Review*, Vol 6(1) 1-24. Retrieved from <http://www.nzlii.org/nz/journals/CanterLawRw/1995>
- Brown, D. 2005. *The Story of Ngatoroirangi Toa Matarau*. Taupo: Taupo District Council. Retrieved from <https://www.taupodc.govt.nz/our-district/our-community/community-sculptures-and-public-art/Documents/Story%20of%20Ngatoroirangi%20Toa%20Matarau.pdf>
- Building (Earthquake-prone Buildings) Amendment Act 2016
- Fa'au, T.N. 2018. Empowering indigenous voices in disaster response: Applying the Mauri Model to New Zealand's worst environmental maritime disaster, *European Journal of Operational Research*, Vol 268(3) 984-995. <https://doi.org/10.1016/j.ejor.2017.05.030>
- Gossage, P. 2016. *Maui and Other Maori Legends*. Wellington, New Zealand: Penguin Group (NZ).
- Harunani, A. 2016. *Architectural Design Award for Tanatana Marae in Waimana/Interviewer: M. McLean*. Te Kaea, Maori Television, Rotorua, New Zealand.
- Hikuroa, D., Slade, A. & Gravley, D. 2011. *Implementing Māori indigenous knowledge (mātauranga) in a scientific paradigm: Restoring the mauri to Te Kete Poutama*. Mai Review, 3. Retrieved from <http://www.review.mai.ac.nz>
- Hohepa-Watene, T.K. 2016. *Te Pātaka Kōrero ā Te Hiko-o-te-rangi Hohepa*. Rotorua, New Zealand: Microfilm Digital Print Limited.

- Hoskins, R. (Writer) & Hoskins, R. (Director). 2011. *Whare Maori - The Wharenui* [Episode two]. In, *Whare Maori*; New Zealand: NZONSCREEN.
- Kahukiwa, R. 2017. *Nga Atua: Maori Gods*. Auckland, New Zealand: Oratia Media.
- Martin, M. 2016, *April 1. End of road for eastern arterial*. Rotorua Daily Post.
- Maxwell, P. 1990. *The Maori Use of Geothermal Energy*. Retrieved from Rotorua Library Te Ārawa Heritage and Research Collection, New Zealand.
- McSaveney, E. 2017. *Historic earthquakes - Earthquakes in Māori tradition*. In *Te Ara - the Encyclopedia of New Zealand* (Vol. 2018): Te Ara - the Encyclopedia of New Zealand.
- Palmer, Q. 2015. November 3. Ruminations on the Problems with the Resource Management Act 1991, *Local Government Environmental Compliance Conference, Auckland, New Zealand*. Retrieved from https://www.planning.org.nz/Attachment?Action=Download&Attachment_id=3538
- Stokes, E. 2000. *The legacy of Ngatoroirangi: Maori customary use of geothermal resources*. Hamilton, New Zealand: Department of Geography, University of Waikato.
- Waikerepuru, D.H. 2012. *August 12. Ruaumoko - the Mountain is Me/Interviewer: G. Science*. Youtube.
- Wilson, H. 2013. *April 13. NZTA on Northland's dusty roads and Rotorua Eastern Arterial highway/Interviewer: S. Morison*. Maraetv correspondence, Maori Television, Auckland, New Zealand.
- Stats New Zealand. 2013. *2013 Census stats about education and training*. Retrieved from <http://archive.stats.govt.nz/Census/2013-census/profile-and-summary-reports/qstats-education-training/post-school.aspx>