BUILDING CODE REVIEW

SUBMISSION TO THE DEPARTMENT OF BUILDING AND HOUSING

28 SEPTEMBER 2007

BACKGROUND

The Institution of Professional Engineers New Zealand (IPENZ) is the lead national professional body representing the engineering profession in New Zealand. It has over 9000 Members, including a cross-section of the engineering community from students to senior Fellows in management of governance positions in important design or construction organisations. IPENZ is non-aligned and seeks to contribute to the community in matters of national interest giving a learned view on important issues, independent of any commercial interest.

The Association of Consulting Engineers New Zealand (ACENZ) represents the consulting industry for engineering and related professionals. The organisation comprises nearly 200 member firms that together employ over 8500 engineers, architects and technicians. This current year, ACENZ members' contribution to the economy will be likely to exceed $1.5 billion in earned fees, which translates into between $15 and $20 billion of capital plant and infrastructure that has been planned, designed and supervised by the consulting engineering industry.

COMMENTS ON BUILDING FOR THE 21ST CENTURY (B21C)

ACENZ and IPENZ congratulate the Department of Building and Housing staff members who have contributed to *B21C,* which we regard as a well-written and considered document. We are generally supportive of the thrust of the review. In this submission we have only addressed those questions where our Members have provided input.

Comments are numbered in accordance with the questions in *B21C.*

1 STRUCTURE OF THE CODE

1.1 IPENZ and ACENZ agree that the Building Code should be structured in a way that reflects the practical needs of Code-users, particularly designers and building consent authorities. We have considered and generally support the new Code framework proposed in *B21C* Table 1 p 19.

1.2 We also agree that general alignment with internationally recognised Codes, such as those of the European Union, will make it easier for goods and services to be traded, and for people to find jobs in other countries.

1.3 Whilst the intent of the 1992 Code was laudable, it has to be acknowledged that the Nordic classification system B1, B2, C etc which subdivided the Code's provisions was unhelpful in ensuring users were at all times fully aware of the regulatory intent. That structure created a "silo" approach to designer thinking, and in our view contributed in part to the regulatory failure which occurred later.

For example:

- B1.3.4 establishes a framework of principles (plus parameters) within which design of any building component or system must be undertaken using (in part) the "loads, forces, and physical conditions" specified in B1.3.3. It is not limited to structural components, which the isolation of the provision within clause B1 might otherwise suggest.

- Proper application of the "robustness principle" listed as "consequences of failure" clause B1.3.4(a) would have ruled out the use of framing timber on external walls supporting directly-fixed, face-sealed monolithic cladding without appropriate preservative, due to the potential for disproportional effects if that cladding leaked.

1.4 We recommend the introduction into regulation of another layer of performance statements, which for convenience we will call the "mid-level" statements, in order to introduce more specificity into building performance.

We perceive a risk that, in attempting to include more and more "specificity" into regulations, there could well be included some unintended prescriptions that will stifle innovation. We believe there is a practical way through this, using the current legislative provisions described in Diagram 2 of *B21C.*

This problem could be solved by introducing within the compliance documents a top tier of "performance statements". For example:

- In modern multi-level residential apartment buildings, there is potential for damage to other property from a number of "environmental" (and other) hazards. One emerging hazard is "consequential loss" damage from ruptured water pipes and sanitary fittings where water flows down from one apartment to another. Whilst the owner's insurance might cover the direct loss, there is a consequential risk of health problems arising from mould growth from incomplete drying. The initial repairs, eg replacing wall linings and floor coverings, is rarely covered by building consent, and often leave latent internal moisture and therefore health problems which persist after the initial repair.

  Our point here is that the "consequence of failure" of this type needs to be anticipated and designed for in a manner similar to fire stopping or acoustic barriers in order to achieve a minimum level of robustness.

1.5 We support the separate identification, in Section 1 - General, of universal parameters affecting building performance as described in *B21C* Part 5, and the supplementary tables in Appendix IV.

- We suggest that the concept of embedded risk be acknowledged and discussed in the proposed Section 1 – General in a more prominent manner than given in Appendix IV. There are two opposing views on this matter: some consider that a building should be 100% safe, while others consider designing for the earthquake with a return period of 2500 years is ridiculously expensive. We suggest that the reasons for accepting a defined degree of risk be outlined near the beginning of the Code so that practitioners have a readily-available piece of text, perhaps with diagrams, that they may reproduce for their clients. The diagrams may include slightly overlapping Gaussian curves that show probability of occurrence of "events", one curve for design action and the other for design strength.

1.6 *B21C* asks on p 12 whether there is a net cost penalty/net cost benefit in the proposed Code revisions, and where benefit/cost improvements could be made. We point out that:

- Providing a facility for "innovation" represents a benefit of a performance-based Code framework. However, this comes at a cost – the cost from ensuring more qualified, experienced specialists operate within the delivery system to ensure compliance is continually achieved. If this does not occur, there is a real risk of regulatory failure.
- Consequently, many of our suggestions will recommend more highly qualified and experienced support within the delivery system, and this will come at a cost. Benefits of more surety of outcome will be society-wide.

2 REQUIREMENTS FOR STRUCTURAL PERFORMANCE

2.1 We have considered the bullet points in Table 2 and agree with the intention of the requirement. However we perceive that the requirement to avoid progressive or disproportionate collapse may be difficult in practice. For example predicting the progressive and disproportionate collapse of the World Trade Centre buildings in 2001 was not done, and insisting that all buildings be designed to withstand such an attack would be prohibitively expensive.

3 REQUIREMENTS FOR VARIABILITY AND UNCERTAINTY IN DESIGN AND CONSTRUCTION

3.1 We strongly support the intent to address variability and uncertainty (perhaps with an intermediate level compliance document) but also wish to highlight the following:

- Most "materials design" standards have been calibrated with an integrated set of load factors, strength (capacity reduction) factors which are internationally-recognised and have been derived using linear regression and other techniques to achieve a known *safety index* β.

  Logically, this formulation could incorporate uncertainty in other areas such as geotechnical.
- It would be useful to calibrate areas of design as well as structure to incorporate similar concepts, tying these into, for example, implied tolerances on dimensions and characteristic strengths of materials, and extending through to factors such as likely lower limits on "acceptable" standards of maintenance.

4 PERFORMANCE REQUIREMENTS FOR BARRIERS

4.1 The 100 mm sphere test indicates that the barriers will feature horizontal as well as vertical members. The horizontal members will make the barrier easy to climb for a small child, and so may increase the danger of a fall. If the barriers featured only vertical members with gaps less than 100 mm wide, then climbing becomes much more difficult.

4.2 The proposed minimum heights appear not to allow alternative "barrier" solutions in special locations, eg theatres, where horizontal projections do provide fall protection. Is the intention to eliminate use of this option?

17 PERFORMANCE REQUIREMENTS FOR PREVENTING THE GROWTH OF HARMFUL ORGANISMS IN STORED HEATED WATER

17.1 IPENZ's literature research agrees that 60°C is necessary to kill *Legionella* bacteria, and we have already drawn attention to this in our submission on *Energy Efficiency in Buildings*, building code clause H1.

17.2 The Department of Scientific and Industrial Research's Physics and Engineering Laboratory did a great deal of research on solar water heaters during the 1970s. This suggested that 60°C is unlikely to be achieved at all times of the year in New Zealand, and so some supplementary heating system would be required.

20 TSUNAMI RISK

20.1 IPENZ previously said that tsunami should be treated like any other risk and the frequency and consequences of their occurrence should be identified and taken into account in the compliance document.

21 FLOODING

21.1 IPENZ previously said that flooding should be treated like any other risk and the frequency and consequences of their occurrence should be identified and taken into account in the compliance document.

21.2 We agree that there should be a unified approach with land use planning, perhaps along the following lines:

- The design criteria should be based around the 1% AEP event (an "extreme case" test) with defined load factors over ULS failure.
- The second level "design case" test of perhaps 2% AEP and/or 5% AEP should also be applied alongside some more general robustness criterion.

21.3 We note that data robust enough to define a 1% AEP may not always be available. A problem of a similar nature has recently been the subject of a dispute between two IPENZ Members, both well-qualified and experienced in the field of flood protection works.

22 TOLERABLE INPACTS

22.1 We support the proposed "tolerable impact" idea embodied in *B21C* Table 8.

22.2 An opportunity should be taken to extend the "tolerable impact" return periods for some further specified events, such as land/ground movement or landslip, eg Table 7, which are not covered by Table 10.

- Foundations for domestic structures in many areas of Auckland are built on expansive soils. Local research, eg BRANZ 2007, suggests 1000-year return periods for the critical "extreme drought" (load factor 1.0) and 300-year return periods for the "design drought", where a minimum required foundation stiffness must be provided with load factor 1.2.

23 ASSIGNMENT OF BUILDINGS INTO PERFORMANCE GROUPS

23.1 We note the similarity to the importance levels (IL) introduced in AS/NZS 1170 and welcome the expanded lists of characteristics and examples.

23.2 We agree that communications towers should be included in PG 4. AS/NZS 1170 includes "towers in rural situations" as an example of an IL 1 structure, but also includes "facilities with special post-disaster functions" in IL 4. This creates confusion, and the PG 4 example should eliminate the confusion.

26 PERFORMANCE REQUIREMENTS FOR DURABILITY

26.1 *B21C* Table 12 suggests that a building shall be designed, constructed, and be capable of being maintained to provide confidence that it will comply with the performance requirements of the Code throughout its life. In answer to question 27 we note that the Code changes over time, and so compliance can only be in terms of the Code as it exists at the time of design. We have difficulty with the phrase "provide confidence" and suggest that it must be carefully defined if it is to appear in the revised Code.

27 DESIGNERS NOMINATING AN INTENDED LIFE

27.1 The Act s 113(3) uses the term *specified intended life* to mean the period of time for which the building is proposed to be used for its intended use. *B21C* uses the term *intended life*, meaning the length of time a building is designed to exist and would be the basis on which a building consent is issued. AS/NZS 1170.0:2002 uses the term *design working life*, defined in 1.4.23, used as a concept that can be used to select the probability of different actions. We suggest that the revised Code and the 1170 definitions are synonymous, and give longer times than those envisaged by the Act.

27.2 Buildings can meet the requirements of the Code only as it exists at the time of design. Experience shows that Code requirements change and become more rigorous over time. For example, Wellington buildings designed 100 years ago typically have only about 10% of the seismic resistance required by today's Code. Hence, the intended life must be seen in the light of the Code requirements at the time of design, and the requirements of the original client. The designer must manage the expectations of the client, and central and local government must manage the expectations of the wider society. This last might be done in the BCA by recording the Code version in force at the time of issuing the building consent, and commenting that the Code may change at a future date.

27.3 Designers need to agree with their clients on the intended life, and state the result near the beginning of the design documentation. This is particularly important for industrial buildings where the intended life may be less than the default value of 50 years. AS/NZS 1170.0:2002 Table 3.3 uses the term *design working life* and uses this in conjunction with the *importance level* to determine the annual probability of exceedance. The APE is a prerequisite to determining the *design actions*. Hence, the intended life must be agreed upon very early in the design process.

27.4 *B21C* Table 12 suggests that designers shall demonstrate that the building will meet the requirements of the Code for the intended life. The word "demonstrate" is somewhat fanciful and may be meaningless in respect of building services and claddings. Any "demonstration" can be only in the context of the Code that exists at the time of design.

27.5 An IPENZ Member engaged in residential design notes that his clients are becoming enamoured of hardwood and softwood timbers other than *Pinus radiata* that do not need chemical treatment to achieve durability. This is partly because "treated pine" is visually unappealing, and partly because they object to the use of artificial chemicals in the structure of their houses. We note that as methods to predict the lives of untreated timbers are not well developed, designers will need to convince clients to accept rather short intended lives.

27.6 We note that 1170 uses the term annual probability of exceedance (APE) and *B21C* uses annual exceedance probability (AEP). This is confusing, and we would prefer to see a single term. Clients expect to see consistent terminology in the documents they pay for.

28 INTENDED LIFE OF 100 YEARS IN SOME CIRCUMSTANCES

28.1 Some road and bridge clients now require a 100 year life for their structures. To achieve this for concrete structures in the sense of durability it is sometimes necessary only to increase the cover over the reinforcing steel. However, on piers and beams exposed to salt water and salt water spray a simple increase in cover does not always suffice, so the designer must resort to a more durable "brew". This has its own problems, as the theories that predict concrete life are difficult and according to one experienced designer not totally believable. Steel structures that are not exposed to the elements will have no difficulty in achieving a 100 year life, but where exposed much greater attention to corrosion protection is required, together with programmed maintenance.

28.2 The suggestion of requiring a 100 year life for structural elements that have permanent effects on adjoining property is reasonable for those elements that are difficult or impossible to inspect or maintain. Ground anchors and some types of retaining wall would come into that category, since they may cause significant loss of amenity if they fail or cause loss of support to an adjacent property.

28.3 Many domestic retaining walls are made in the form of timber palisades, and the timber manufacturers publish design lives less than 100 years. Despite the fact that their failure could endanger other property, we believe that they should be permitted, as individual poles in the palisade can be replaced.

29 PERFORMANCE REQUIREMENTS IN RESPECT OF MAINTENANCE

29.1 IPENZ has previously stated that it is very important that the Code make provision for a maintenance plan.

29.2 During the 1970s and 80s IPENZ Members developed base isolation systems that provided defence against earthquakes. Some relied on the plastic deformation of steel and others on the plastic deformation of lead, but all were designed to need zero maintenance unless a major earthquake occurred. If necessary, they were then accessible for inspection and replacement. For example, Wellington's Central Police Station is base-isolated with a system that includes hypohemispherical bearings that carry the entire weight: these feature a solid lubrication system that is expected to last without maintenance for the life of the building. The system also includes lead-extrusion dampers that act only during earthquakes. At the time of design, the idea of a maintenance plan requiring the bearings and dampers to be pumped up with grease at periodic intervals was considered, but was dismissed as risible, so we deliberately chose a zero-maintenance design.

29.3 In respect of specified systems such as lifts, fire pumps, and heating, cooling, and ventilating systems, we agree that the design must allow access for several maintenance and replacement cycles, and note that these cycle times will usually be less than the life of the building. The designer could specify the maintenance requirements for the initially installed specified systems, but could not do so for replacements installed at a later date.

30 STRUCTURAL PERFORMANCE REQUIREMENTS

30.1 In answer to question 27 we noted that designers can consider only the Code as it exists at the time of design, and that the term “demonstrate” has little meaning. The same ideas apply here.

31 MEASURES FOR CONCURRENT DEMANDS

31.1 We agree with the proposals for considering concurrent demands expressed in *B21C* Table 13.

32 STRUCTURAL PERFORMANCE REQUIREMENTS

32.1 We agree that the designer should consider the bullet-points in *B21C* Table 13.

33 REQUIREMENTS TO RESTRICT ACCESS TO HOT SURFACES

33.1 IPENZ previously said that it is appropriate for hot and cold surfaces to be treated consistently with hot and cold pipes. We also suggested that fixed and portable appliances be treated differently, such that [hot] fixed appliances in living and working areas have restricted access, and that portable appliances be relied upon only to temporarily boost temperatures.

33.2 We agree that access to surfaces or substances of a temperature higher than 50°C should be restricted, except for cooking elements. This would apply in early childhood centres, schools, aged care facilities, and hospitals.

33.3 We note that these restrictions are not being suggested for homes and commercial buildings.

34 ALIGN CODE WITH HASNO ACT

34.1 We agree that regulatory requirements should be consistent, and where this is not possible the hierarchy should be defined.

35 MAX SOUND LEVEL FOR FIRE ALARMS

35.1 We suggest that the Code sets the performance requirement that people be protected from harm, and that the current New Zealand Standard for fire alarms provides an Acceptable Solution.

36 PERFORMANCE REQUIREMENT FOR INDOOR AIR QUALITY

36.1 IPENZ previously said that particulates emissions are a significant issue.

37 PERFORMANCE REQUIREMENT FOR THERMAL CONTROL

37.1 IPENZ previously said that it was important to provide for minimum indoor temperatures in residential and commercial buildings, and suggested several active and passive means for doing so.

37.2 IPENZ previously said that it was not very important for the Code to provide for a maximum indoor temperature.

37.3 We agree that habitable spaces of buildings where people work and live should be able to maintain a thermal environment that satisfies 85% of the population, but in any case should not be less than 18°C.

38 PERFORMANCE REQUIREMENT FOR INTERNAL MOISTURE CONTROL

38.1 IPENZ previously said that if it is intended to make any inroads into the build-up of moisture in homes, then it is essential to mandate on the minimum airflow that should be provided, the reduction in need of unflued gas heaters, and an increase in the ventilation in kitchens and bathrooms.

45 RAW WATER

45.1 IPENZ previously said that the collection of rainwater must be associated with the appropriate usage and treatment of greywater.

46 CONTINUOUS I.D. FOR DRINKING AND NON-DRINKING WATER SYSTEMS

46.1 We agree that water pipes with non-drinking water shall be continuously identified.

46.2 We note that many industrial plants have pipes that carry liquids other than water, and that these also need to be continuously identified.

47 PERFORMANCE REQUIREMENTS FOR WATER RE-USE

47.1 People in Kapiti District, which suffers from water shortages in summer, have been vocal here, especially in respect of greywater. They suggest two categories: indoor and outdoor, and claim that the E. coli limit is too strict for outdoor use. We note that people sit in bathwater that may contain dilute faeces, and parents bathe small children one after another in the same water.

47.2 We are aware of at least one system for collecting residential greywater in an external gulley trap and distributing it through pipes buried in the topsoil. The engineer who has developed this claims that

- it is economic,
- because there is no human contact the *E. coli* count may be higher, and
- it is necessary in areas that suffer from summer water shortages.

48 BUILDINGS WITH ROUTES ACCESSIBLE TO PEOPLE WITH DISABILITIES

48.1 We agree that multi-unit dwellings be added to the list of buildings that must provide an accessible route with features for people with disabilities.

48.2 A wheelchair-bound IPENZ Member suggests a number of detailed requirements that might be included in a revision of NZS 4121 *Design for access and mobility – buildings and associated facilities*. We note that this Standard has special status in the Building Act, as s119(2) states that it is to be taken as a compliance document.

- All internal and external building doorways to have minimum clear opening widths of 900 mm.

- All garden pathways to be a minimum of 1000 mm wide, with all garden gates to have minimum clear opening widths of 900 mm. Latches, handles, and other gate opening mechanisms to be mounted between 800 and 1000 mm above path level and be easily accessible to seated wheelchair users. Wherever practical to do so, a level or nearly level area at least 1000 mm long should be provided on both sides of all gates.
- All interior hallways and passageways should have a minimum of 1200 mm clear width.
- Steps should be avoided whenever practical and possible to do so. Ramps or ramped pathways with a maximum gradient of 1 in 12 should be used to access any elevated doorway, house area, or other elevated part of the property on which the house is situated. Gradients up to 1 in 10 are the steepest acceptable ramps for other than emergency exit ramps on existing buildings.
- All new student and traveller multi-unit accommodation buildings shall provide at least one fully accessible accommodation unit with a wet area shower and toilet, accessible throughout the rest of the building, for every six units.
- All fully-accessible bathrooms shall have bathroom vanities that can be wheeled under, i.e. be no less than 700 mm from the floor to the underside of the basin. Toilets must be approachable from one side as well as from the front.
- Bathrooms, shower areas, and toilets in existing dwellings undergoing structural changes that include any one or any combination of: new entry doors; shower areas; wall linings and floor coverings; and toilets shall be made as wheelchair accessible as achievable within the confines of the existing area. Where these existing bathrooms and toilets are located side by side in the same dwelling and both are being refitted, then the two separate rooms shall be combined into one larger more wheelchair accessible room, unless a wheelchair accessible bathroom and toilet is already included in the same dwelling, and unless the building or building site is not wheelchair accessible.
- At least one wheelchair accessible wet area shower and toilet area must be provided in any accommodation building and in all new residential dwellings. All new kitchen, bathroom, shower, and toilet areas shall have wheelchair accessible stepless doorways.
- New laundry, bathroom, and kitchen areas must be accessible to wheelchair users. All walk-in wardrobes, storage cupboards, and kitchen pantries must have clear doorways at least 800 mm wide.
- All new garages shall be wide enough to allow for safe wheelchair access to or past the vehicles parked inside. This requires 1000 mm minimum clearance between each vehicle and between a vehicle and a wall. Access on one side is adequate only if it gives the best approach route to the accessible emergency exit door.
- Access to any building via internal access garage doors must be wheelchair accessible with a minimum 900 mm clear width access path to these doors.
- Wall mounted light switches and electrical controls shall be wheelchair accessible and installed between 800 and 1200 mm above floor level.

- Electrical power outlets are to be mounted as low as practically possible above kitchen, laundry, and other benchtop surfaces and as close as possible to benchtop fronts.
- All new residential domestic buildings must have a minimum of two external doors that are accessible to wheelchair users for emergency exit purposes.
- For alterations to existing residential domestic buildings, a wheelchair exit onto an existing external porch, or verandah, may be acceptable for one of these emergency exit routes, if there are no other practical alternatives and this location is readily accessible to Fire Service and other rescuers.
- Multi-storey residential buildings must have: wheelchair accessibility within their upstairs and downstairs areas; a stairway at least 1200 mm wide to allow for possible future installation of a wheelchair stair lift; or, have a suitable area for future installation of a wheelchair lift, positioned either internally or externally to the building.
- Any new multi-storey backpacker, traveller, or other forms of commercially-run accommodation, shall have permanent wheelchair (i.e. ramp of lift) access to their upper floors.
- All existing backpacker, motor and holiday camp accommodation; and other forms of traveller accommodation buildings must, within ten years from the Building Code's wheelchair accessibility requirements becoming operative, provide: at least one fully compliant wheelchair accessible accommodation unit; wheelchair access to any associated kitchen, laundry, toilet and bathroom; wheelchair access to other communal use areas. Their reception and visitor toilet areas should also be wheelchair accessible. These accessibility improvements shall be as compliant as practicable, given existing space and or site restrictions.

Dispensations to any wheelchair accessibility provision(s) may be given if they can be justified for any of the following reasons:

- There is no way to access the building site because of extreme site conditions such as
    - no vehicle access
    - no ramp access
- Back country accommodation huts need to be wheelchair accessible only if they are accessible to boats, airplanes, helicopters, a fire-fighting road, or a wheelchair accessible walking track.
- There is insufficient existing internal building area to make wheelchair access possible.
- The occupant(s) have a type of disability that requires different needs for mobility, hygiene, and the tasks of everyday living. Alterations to suit these types of disabilities shall not totally preclude future wheelchair access.

(We recognise that dispensation is an Act and not a Code compliance issue.)

The typical range of wheelchair widths given in NZS 4121:2001 needs to be increased from its current "600 to 700 mm range" to a more representative "600 to 800 mm" range. The increased width arises because of the "bottom out" cambered wheels used on some modern wheelchairs, and the wider chairs need by wider people. NZS 4121:2001 needs to be amended accordingly.

49 PERFORMANCE REQUIREMENTS FOR EXCLUDING NOISE

49.1 IPENZ previously said that it was very important to provide protection against high noise level sources external to the building.

49.2 It is important for the Code to require that people be protected from external noise (eg aircraft). The sound levels and attenuation performances should be specified in the compliance documents.

50 CO2 EMISSIONS AS A MEASURE OF RESOURCE EFFICIENCY

50.1 We note that designers consider the resources used in the construction, operation, maintenance and demolition of buildings as a matter of course, in the senses that the cost of the design will be sensitive to all of these, and that all must be possible. However, designers rarely provide documents specifying methods of executing them all. Should the revised Code explicitly require these, the cost of design and documentation will increase.

50.2 One new suggestion here is to promote the use of recycled materials. Recycled materials may have properties inferior to new materials (e.g. old steel beams may have lost some of their cross-section to rust, or may have poorer brittle-fracture properties) and so the new design would have to account for these inferior properties. This will often be possible, but will incur higher design and inwards-goods inspection costs in evaluating the poorer properties.

50.3 Another suggestion is to promote the use of sustainable materials. This is often seen to favour timber, as plantations can be regrown many times, the trees take up CO_2 through photosynthesis, and then sequester the carbon in the timber. Recently, the advocates of concrete have promoted their material as sustainable, because all the raw materials are locally available, including coal, waste oil, and worn tyres to fire the cement kiln; and the high thermal mass may be used both to insulate the building and to provide a daytime sink for solar energy that can become a source at night. The advocates of steel point out that their material is totally recyclable and so is sustainable in that sense. We can expect to see these arguments further developed and to become ever more sophisticated as the Act's purpose to promote sustainable development takes effect.

50.4 *B21C* suggests on p 59 that one-off CO_2 emissions associated with building materials would be divided up over the life of the building. The designer would need to consider what the optimum intended life for the building would be. In answer to question 27 above, we have said that designers need to agree with their clients on the intended life of the building. Because a subsequent owner might decide to lengthen or shorten the life of the building, the original designer should be required only to agree with the original client on the intended life. The designer should then have to consider the resources used only with that life in mind.

50.5 *B21C* suggests on p 59 that 'assessing CO_2 emissions from water [use] …could promote rainwater harvesting and the use of non-potable water…' We suggest that promoting rainwater harvesting, using stormwater on site (or at least reducing the peak demand on the public stormwater infrastructure) in irrigating plants that transpire the water to the atmosphere are all good things in their own right, and that there is no need to add the complication of assessing CO_2 emissions.

50.6 We go further and suggest that the Code could require the designer to consider the building's reliance on public infrastructure services. If measures to harness the sun and the rain on-site could reduce the building's reliance on public infrastructure, this could be seen to be desirable. Such self-sufficiency is likely to be initially expensive. The designer would then have to compare the payback period for a high initial cost but low running cost design with a lower initial cost but high running cost design. If the breakeven time is less than the design life for that system (which is likely to be less than for the building as a whole), then the designer and client might together choose the self-sufficient system that made fewer demands on public infrastructure.

50.7 We find ourselves on the horns of a dilemma.

On one horn is the difficulty of calculating CO_2 emissions made in the manufacture of the building materials, constructing, operating, and eventually demolishing the building, as the rules for what is in and what is out of the calculation, and the conversion factors, will continually change. Some of our Members go even further, and maintain that it is not necessary to make the calculation, as there is no need to reduce emissions.

On the other horn is the undoubted need, in the minds of many of our Members, to reduce CO_2 emissions, and if they cannot be reliably calculated, how can we know that one design is superior to another?

We might avoid the issue by saying that calculating the CO_2 emissions is too difficult, and that it is better to measure the quantity of fossil fuels burnt in power stations, manufacturing plants, and commercial transport, and require these to decrease with time. But this does not provide designers and their clients a direct incentive to improve.

We might also tackle the issue head on by saying that engineers are amongst the best-qualified people to make these new calculations, and so should provide this service, for a fee, to their clients.

50.8 Somewhat reluctantly, we find ourselves forced to agree that some of the engineering profession must take part in discovering the best ways to calculate CO_2 emissions, and then teaching the rest of us how to do it.

53 Fire design scenarios

53.1 The idea of fire scenarios for testing performance-based designs has merit and we would like to assist in establishing suitable examples. Similarly, we would like DBH to demonstrate that designs based on the Acceptable Solution meet the Code's performance requirements when tested against the scenarios.

54 Fire design process

54.1 IPENZ has convened a Fire Engineering Taskforce with members drawn from the NZ Chapter of the Society of Fire Protection Engineers (a collaborating technical society of IPENZ), the Department of Building and Housing, territorial authorities, and the NZ Fire Service. The Taskforce has completed its initial work by publishing its report *Hot Topics,* and distributing this widely within the communities of fire design engineers, local and central government, and the Fire Service. *Hot Topics* recommends that the International Fire Engineering Guidelines (IFEG) be used for design, and that the New Zealand Construction Industry Council (NZCIC) guidelines be used to document the designs.

55 FIRE AND EMERGENCY SAFETY

55.1 IPENZ recommends that building control authorities use the report *Hot Topics* to decide on the adequacy of fire design documentation submitted in support of applications for building consent.

55.2 IPENZ previously said that buildings with access for disabled people should provide egress for disabled people.

55.3 A wheelchair-bound IPENZ Member suggests that "Evacuchairs" must be available near stairways at every floor level above ground level in all commercial multi-storey buildings. He states that these devices were used successfully during the Twin Towers evacuation on 9/11.

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