SECOND REPORT OF THE COMMITTEE
FOR THE YEAR ENDING 31 MARCH 1978

Standing Committee
on Structural Safety
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## REPORT OF THE STANDING COMMITTEE

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REPORT OF THE STANDING COMMITTEE FOR THE YEAR ENDING 31 MARCH 1978

1. CONSPECTUS

When the three sponsoring Institutions set up the Standing Committee on Structural Safety in 1976, there could be no certainty that the effort and cost of the Committee would be worthwhile. The general attitude was that the positive approach was better than the negative, and that the Committee should be formed and given three years in which to find out how to work and to evaluate the job. By the end of 1978, the Committee will be reviewing all its work up to that time and planning what it should recommend to the Presidents and Councils of the sponsoring Institutions.

At the end of the second year's work, four general points have become clear. First, whenever the Committee has invited a person or an organisation to give information on a safety matter the response has been thorough and valuable. The Committee believes that its interest has been welcomed and that discussion with the Committee has been stimulating. Although its effects cannot be analysed, this part of the Committee's work is of great worth and may prove important in the longer term.

Second, when it began, the Committee did not know how many suggestions, complaints or 'worries' would be received from professional men or the public at large about the safety of structures. The guess was that the total number would be large. In fact, it has been small but, almost without exception, the points
made have been pertinent and useful. Recently, there are indications that the number of communications being received is increasing. It follows that most of the work of the Committee so far has either been to learn or has been based on safety matters suggested by members of the Committee.

Third, the Committee in using the freedom given to it to take whatever action it thought fit in any particular safety case, including the opportunity of consulting the three Presidents if that seemed necessary, has found that it usually asks a Government department to take some action. Civil servants and ministers are naturally reluctant to issue papers and try to change regulations because of the many complaints today about too much paper and too much government; but the Committee nevertheless finds itself suggesting certain actions to Government departments.

Fourth, and this point is related to the third, the Committee is beginning to think that some of its work should be summarised and made more widely available to the members of the sponsoring Institutions and also to the Royal Institute of British Architects and some others. Part of the process of communication should be to follow up in certain cases, after say a year or two, either to draw more attention to a particular matter or to find out if the results of relevant work have had any effect.

An expansion of the comments made above on the third point may be of interest and gives the Committee a chance to mention some of its actions. The first report of the Committee called attention to the risks of a serious double accident implied by the frequency with which bridges are struck by vehicles with high loads. The three Presidents wrote jointly to the Secretary of State for Transport making certain proposals. The Secretary of State replied, saying that he fully shared the concern expressed by the
Presidents and had already instructed his Department to take certain actions which would cover six of the seven proposals made by the Presidents. The exception was that he could not adopt the proposal to introduce a general height limit for vehicles because there were some serious disadvantages. The Committee understands the disadvantages but believes firmly that it is as logical and necessary to restrict over-height vehicles to specified routes as it is to restrict vehicles which are too wide or too heavy.

Another safety matter where the Committee felt it requisite to approach the Department of Transport related to the publicity which had been given to a strengthening technique using epoxy resin for some bridges at Swanley. The Committee thought the impression had been conveyed that the technique was proven and reliable whereas it is still experimental. The point was accepted and at a recent conference at TRRL, attended by bridge engineers from all over the country, it was agreed that more research was required before the technique could be universally recommended.

Two safety matters have been raised with the Department of the Environment. The first relates to the risk of using liquefied petroleum gas (LPG) in high-rise buildings where supply of natural or town gas from the gas board has been denied for safety reasons. The second relates to the risks of injury to the public from the falling of claddings from upper parts of buildings.

The Committee wrote to the Department calling attention to the LPG risks and is awaiting a response. The Committee also made a direct approach to one of the major suppliers of LPG. The company took a very responsible attitude and, after consideration, instructed its agents that LPG should not be used in high-rise flats in which mains gas has not already been provided and, further, LPG should not be used above the fourth storey in flats.
or maisonettes of traditional construction. Similar action has now been taken by another major supplying company.

The Committee has been aware that there are risks connected with claddings. The situation appears to be that, although claddings dating from 1945-1970 are most likely to be suspect, those dating from 1970 onwards are not immune from problems. The Committee suggests certain actions which are explained in the later section on claddings.

The Committee is always conscious that a 'scare', whether justified or not, can be very costly. In the case of both LPG and claddings, a 'scare' would be very unfortunate and unnecessary. The Minister for Housing and Construction was therefore requested to nominate an officer with whom could be discussed the best methods of handling such matters where action is required, but not action which would lead to a 'scare'.

The first report of the Committee referred to correspondence with the Secretary of State for Education on the point that warning might be issued about certain schools, used by the public out of school hours, in which the fire resistance of the structure might not be of the standard which a modern building should have. The Secretary of State considered the points made but decided that no action was necessary on the part of her Department. She accepted that some educational buildings, built before 1975, did not comply in all respects with the Building Regulations, but argued that those buildings were no less safe because of other features introduced, such as good means of escape. This poses the question as to why a Government building should conform to regulations which are different from those which apply to all other buildings in the same area; this has wider implications. The resolution of this anomaly is considered very important although outside the sphere of the Committee.
The Committee, during its discussions, sometimes touches on questions of duty of care and responsibilities of the professional man towards his clients and to the public. Sir Patrick Graham was good enough to produce a note for the Committee, and the Committee thought that this note would be helpful to others. It is therefore reproduced as Appendix 1 to the Committee's report.

Finally, a fuller account of all the work of the Committee during the second year is given in the section entitled 'Topics Discussed'.
The Committee discussed the following topics during the second year 1977 to 1978:

2.1 The Influence of Building Regulations on Structural Safety
    May 1977

2.2 The Influence of Safety Factors on Overall Structural Safety
    September 1977

2.3 Investigation of Structural Failures
    October 1977

2.4 The Relevance of Agreement Certificates to Structural Safety
    January 1978

2.5 Cladding failures (an extension of earlier discussions)
    February 1978

2.6 The risk of brittle fracture in high tensile steel structures (an extension of earlier discussions)
    February 1978

2.7 Liquefied Petroleum Gas Containers in Dwellings

2.8 The Stability and Durability of Timber Roof Trusses

2.9 Fires in Schools: schools and other buildings exempt from control under the Building Regulations (an extension of earlier discussions)

2.10 Tolerances and Accuracy in building

2.11 Responsibilities of Local Authority Inspectors

2.12 The Strengthening of Reinforced Concrete Bridges by attachment of resin bonded steel plates

2.13 Damage to Bridges through Impact by High Vehicles and High Loads (an extension of earlier discussions)
2.1 THE INFLUENCE OF BUILDING REGULATIONS ON STRUCTURAL SAFETY: DISCUSSION WITH A BUILDING REGULATIONS OFFICER
May 1977

A number of trends in construction appear to be leading to lower levels of safety but there is no formal way of monitoring them.

Two particular trends stand out: firstly, towards repetitive structures or elements, which give extensive problems if there is a fault in the original design or construction; secondly, towards more complex building design, related to very tall or slender structures and with potentially high consequences of failure.

Another trend is towards more widespread and indiscriminate use of new materials. In the face of commercial and economic pressures and of enthusiasm for novel construction, it is difficult to enforce a view that long-term performance may be unsatisfactory.

The failure of long-span building structures has indicated two basic sources of trouble: (i) lack of attention to technical details of structure; (ii) imposition of cost limits.

(i) Codes of Practice and regulatory documents tend to be used as rule books and sometimes discourage the application of judgement and basic engineering principles. In situations not covered by, or to which a Code is not exactly applicable, matters of technical detail may be overlooked. One solution to this problem would be for Codes to give performance requirements rather than design guidance, which could be given elsewhere.

(ii) The increasing use of yardsticks and other limits to minimise the capital costs of building may lead to lower levels of safety and to higher maintenance costs.
The repetition of structural elements provides economy in construction but, in view of the higher consequences of failure, repetitive elements should receive much greater attention with regard to detail, development and testing.

There is a danger in the search for economies that safety factors will be reduced below a 'threshold', resulting in more failures. Recent developments by the Construction Industry Research and Information Association (CIRIA) and others in the application of reliability theory to the determination of safety factors may clarify the situation.

In the field of low-rise housing construction it is important to distinguish between robustness of elements and overall stability. Attention should be drawn to the connections between elements and the need to tie all parts of the structure together.

A number of failures or potential failures occur due to events or changes in circumstances outside the knowledge and control of the designer and the public. An example of this is the recent increased use of LPG in high-rise flats.

The effectiveness of building control in Great Britain is variable but generally, even on larger projects, building control officers are unable to give sufficient attention to checking design concepts and details and have little control over site supervision. Building control officers can and sometimes do employ consultants to check unfamiliar structures but, even then, the checking is not comparable with the German proof-engineer system in which the proof-engineer shares design responsibility and is in a strong position to veto or change techniques and materials. The dialogue between the designer and proof-engineer can help to ensure that all aspects of the design and construction processes have been considered.
2.2 THE INFLUENCE OF SAFETY FACTORS ON OVERALL STRUCTURAL SAFETY

September 1977

The difficulty in quantifying partial safety factors was foreseen in the Report of the Pugsley Committee on Structural Safety (1971). Safety factors directly affect the cost of construction but control less than 10% of the failure risk for most civil engineering structures; they neither counter errors of design and workmanship nor cater for unforeseen loads.

CIRIA Report 63 (1977) aimed to provide a tool enabling Code of Practice Committees to quantify partial safety factors. Rational selection of partial factors would provide more consistent reliability between structures of different type. The effect of reduced safety factors on the probability of failure is unknown but Report 63 proposals did not envisage a diminution in the average level.

The effort and cost involved in setting partial safety factors and providing all the associated design data ab initio would be enormous. Sensitivity studies could establish the most important areas of uncertainty for attention. For example, bridge loading is much more certain than wind and wave loading on an offshore structure.

The determination of serviceability requirements is a neglected area.

Increased expenditure on design and construction control might well be cost effective. The Merrison Committee recommended investigation into design expenditure, including a study of current calculation and checking standards. The Committee found that these standards varied considerably for bridges and it might be inferred that the standards for building design and control vary even more widely.
Experience in bridge design suggests that the increase of about 10% in total design costs for checking has been worthwhile in identifying mistakes in principle and might justify the use of lower safety factors when independent checking is done. The comparatively small proportion of risks controlled by safety factors emphasizes the need to turn attention more to other areas, such as the control of workmanship, materials control and communications.

2.3 INVESTIGATION OF STRUCTURAL FAILURES
October 1977

The Building Research Establishment (BRE) has investigated most of the substantial structural collapses of public sector buildings. These collapses have been relatively few in number but have afforded the Establishment sufficient experience to develop the necessary skills. In each case the aim has been to establish technical causes of failure and identify any measures necessary to prevent repetition, not to determine responsibilities.

Most difficulties regarding investigation and action are encountered in the private sector and on the 'political' front.

Private owners may seek legal advice, causing delay. The need to secure and reinstate the structure rapidly may lead to evidence being destroyed or covered up prior to the investigation. If a material or product becomes suspect during investigation, the manufacturers' fear of commercial disadvantage tends to outweigh considerations of safety.

The main 'political' problem arises where warning must be issued to owners of structures at risk. It is very difficult to
give the appropriate remedial measures sufficient publicity for implementation, without causing public concern through misinterpretation, particularly by some sections of the national press.

There would be advantages if, in certain circumstances, the facility to 'freeze' the site of a structural failure was available.

Sources of failure, which have affected many structures, include high alumina cement, calcium chloride in concrete, glued joints in timber, timber trussed rafters and steel lattice portal frames.

Several organisations, including the Greater London Council and Property Services Agency, have developed feed-back systems to deal with structural problems in their own areas; but, at present, there is no common pool for information about structural failures.

There is a need to include safety checks in regular maintenance inspections of buildings. A method for such checks is needed and this should be included in a maintenance manual.

2.4 THE RELEVANCE OF AGRÉMENT CERTIFICATES TO STRUCTURAL SAFETY
January 1978

Agrément certificates give assessments of marketed products not covered by deemed-to-satisfy clauses in the Building Regulations or by Standards, Codes, etc. Certificates estimate a product's performance in specific typical conditions of use, covering safety, habitability, durability, practicability and maintenance.
A certificate gives the Board's opinion as to whether a product satisfies the Building Regulations or merits a waiver thereof. The Board is keen to see the introduction of Type Approvals under the Building Regulations, based on certification of individual products.

Powers exist to implement the Type Approvals system, but legal difficulties have hindered progress. If implemented, local authorities would be faced with fewer difficult technical decisions over new products.

The Board will not publish information about a product which has failed to be certified unless the use of that product could prove dangerous. Certificates may be withdrawn if manufacturers make excessive claims or the Board's six monthly inspections reveal an unsatisfactory standard of materials quality and production.

The Board makes every effort to allow for all relevant safety and serviceability requirements when deriving safe loads for certificates. When these factors may be subject to design variations, comprehensive load data is provided for the product in its certificate.

Note: Since this discussion the Department of the Environment has set up a Committee under Mr Philip Bennett to review the functions and objectives of the Agrément Board.

The Standing Committee is to visit the Agrément Board in July 1978 for further discussion.
Prior to 1950, cladding for multi-storey buildings was usually of brickwork, with an external surface of natural or reconstructed stone. Stone blocks were relatively small and traditional methods of masonry construction were applied, with the stone facing well bonded into the backing walls and with two-thirds of the wall thickness supported on the structural frame. Generally, this form of construction has given little trouble.

In the early 1950's, there was a move towards lighter claddings of various types and, to remain competitive, masonry cladding was progressively reduced in thickness to 100 mm and by 1960 to 50 mm. Bonding stones were omitted and backing walls reduced to a single leaf with a cavity to the facing. To a large extent the method of fixing was left to the stonework sub-contractor. Ferrous and galvanised fixings of various types were often used, with a consequent high risk of corrosion.

The satisfactory fixing and support of precast concrete claddings also presented problems, particularly because inevitable dimensional variations in the structural framework resulted in some fixings being omitted. Movement joints, necessary to accommodate thermal expansion and creep, were usually inadequate and sometimes not provided at all.

A fashion towards larger areas of glazing developed. Architects in some cases relied upon the cladding sub-contractor to decide fixing arrangements and did not consult the structural engineer. The division of responsibility at the interfaces was not clearly defined.

The London Amending Bye-Laws came into force in 1965 and required attention to the design and erection of claddings and fixings.
In regulations applicable to the rest of the country, including the 1976 edition of the Building Regulations, there are no special requirements for claddings. A number of failures have been drawn to the attention of the professions and industry. However, for much of the work carried out between 1950 and 1970, guidance was inadequate and, consequently, there is a high risk that masonry and concrete claddings erected during this period will continue to fail.

There is now sufficient information available on the design and erection of claddings to reduce the risk of failure on future buildings to within acceptable limits. The widest publicity possible should be given to the following: provision of adequate movement joints; use of corrosion resistant fixings and supports; adequate allowance for dimensional variations and other construction variations; ensurance that the cladding material is of appropriate quality and that the claddings, their fixings and supports, can be inspected easily and maintained throughout the life of the building.

With regard to existing buildings, it is recommended that inspections be made of those below the standards now known to be necessary, taking particular account of the features enumerated above and giving priority to buildings having high consequences of cladding failure; for example, those fronting busy streets and crowded areas. A checklist of the type now in course of preparation by the Institution of Structural Engineers on the structural appraisal of constructions would be a valuable aid to inspection. The repair of defects will often prove difficult and expensive.
It has been suggested that welded high-tensile structures built about 20 years ago might be at risk from brittle fracture because, at that time, there was insufficient knowledge and experience in design and fabrication practice for these structures and inadequate control over materials quality. The structures most susceptible initially to brittle fracture would be exposed structures of plate or box girder construction built of welded high tensile steel construction prior to about 1960.

No such failures are known to have occurred in bridge structures in the UK, although 119 road bridges have been built in welded high tensile steel since 1966. Brittle fractures have occurred, however, in ships, pipelines, storage tanks, pressure vessels and in cranes. Several bridges overseas have suffered brittle fracture (e.g. Hasselt in Belgium, Duplessis in Canada, Kings in Australia, and in bridges under construction in the USA).

Features contributing to brittle fracture in welded plate tension zones are: complexity of details, presence of stress raisers, thick plates, low notch ductility and poor weldability of the steel, poor welding practice, high residual stresses and low temperature.

Although the original risk was greater with structures built before current recommendations were applied, the longer a structure has been in service, the less likely it is to fail by brittle fracture because applied loads redistribute and relieve residual stresses and stress concentrations. However, some risk remains, especially if the structure becomes liable to resist higher loadings than it at present sustains.
2.7 LIQUEFIED PETROLEUM GAS CONTAINERS IN DWELLINGS

The explosion forces due to ignition of liquid petroleum gas (LPG) in a room are comparable to those from town gas or natural gas. In 1977, eight incidents were reported in which explosions of LPG caused significant structural damage to dwellings compared with 42 incidents involving natural gas. Due to increased costs of electricity the consumption of LPG for heating has grown considerably in recent years.

Following the Ronan Point incident in 1968, many high-rise blocks of flats throughout the country were appraised, and strengthened where necessary, to withstand a standard static pressure of $0.0345 \text{ N/mm}^2$. Where no mains gas was incorporated, or where it had been removed, it was permissible to appraise existing structures using half this standard static pressure; numerous blocks were dealt with in this manner and, in some cases, no strengthening was required. The Standing Committee's concern, therefore, is that the use of LPG in those flats of large panel construction which have been appraised on the basis of no mains gas supply being present, could lead to a serious incident of progressive collapse, similar to that at Ronan Point. Some local authorities aware of the risk have banned the use of LPG in high-rise flats but others have taken no action.

In addition to drawing the Department of the Environment's attention to this danger, the Standing Committee had discussions with representatives of the principal national LPG suppliers, who have co-operated by sending the following instructions to all their agents:

"Although there is a Fire Prevention Guide No 4 - Safe Use of LPG in Residential Premises, published in 1976, which we support, and which gives guidance on the safe use of LPG in premises of various types,
it is important to emphasise our current policy in meeting the requirements of the Code, which we ask you to implement as follows:

(i) **High-rise blocks of flats**
   LPG should not be used in high-rise flats, either in cylinders or piped from the outside if, on safety grounds, the mains gas has been disconnected or a supply refused.

(ii) **Flats and maisonettes of traditional construction over 2 storeys high**
   LPG can be piped in from the outside but LPG cylinders should not be allowed inside unless the block has alternative means of escape and has balcony or deck access which can be used for cylinder changing. Irrespective of the above, cylinders should not be used above the fourth storey and lifts must not be used for the transportation of cylinders."

However the Standing Committee is concerned that many local authorities are still unaware of the risk.

### 2.8 THE STABILITY AND DURABILITY OF TIMBER ROOF TRUSSES

The Standing Committee has considered questions of the stability and durability of pre-fabricated or proprietary timber roof trusses incorporating galvanised metal jointing plates.

The Committee is seeking further evidence on the durability of the galvanising treatment, especially when the teeth are punched afterwards and on the effect of moisture changes in the ageing of the timber on the long-term performance of joints.
The Committee also studied the Building Research Station Report on the collapse of the sports hall at Rock Ferry Comprehensive School in which inadequate lateral bracing had been provided between the manufactured trussed rafter units.

2.9 FIRES IN SCHOOLS: SCHOOLS AND OTHER BUILDINGS EXEMPT FROM FIRE CONTROL UNDER THE BUILDING REGULATIONS

In its first Report, the Standing Committee discussed the question of fires in schools and drew attention to the fact that many schools built before 1975 did not comply with the Building Regulations in respect of fire protection to structural members, provisions for fire barriers and some other matters. The number of fires in schools, many due to arson, has increased considerably during the last ten years. The Standing Committee has written to the Secretary of State for Education and Science, endorsing the Building Research Establishment's recommendations for reducing fire spread in these buildings and recommending that the Education Authorities' attention should be drawn to these deficiencies, particularly before using or applying for a licence for use of a school building by the general public out of school hours.

The Secretary of State accepted that some educational buildings did not meet the requirements of the Building Regulations but did not accept that they were less safe than buildings which do conform:

"The Department's policy is to set standards in which structural fire protection is only one of a number of aspects of fire safety including means of escape, fire alarms and every day precautions by the occupants."

However, the Standing Committee believes that Education Authorities should be reminded that some schools have lower fire
resistance than is thought appropriate for other buildings. The Standing Committee accepts that the Secretary of State must decide whether or not to act on its advice but the professions and the professional officers of the Education Authorities have a duty of care in this matter and the Presidents of the Institutions have been advised accordingly.

The Committee also considers that this matter should be brought to the attention of Local Authorities, who are responsible for issuing licences for public use of a building and may not be aware of the different standards of fire protection.

Although the subject of fire protection in schools has been singled out for special consideration, some other structural deficiencies have been noted in schools and other buildings exempt from Building Regulations control or from independent safety check by suitably qualified persons. The need to fulfil a construction programme within prescribed cost limits should not override the need for structural design decisions to be considered and taken by professional engineers.

2.10 TOLERANCES AND ACCURACY IN BUILDING

Fears have been expressed that the relatively recent introduction of tolerances in building work, necessitated by the greater use of factory produced components, is creating difficulties which could affect structural safety. These difficulties arise partly from lack of understanding of the theory and practice of tolerances and partly from the nature of building work, in which the designer is not always sufficiently aware of the details of the construction required. The situation often arises in which the
builder cannot be provided with complete information at the time of tendering; when erecting one component, he may not know the details of the component that it mates with.

When a problem of lack of fit occurs on site, the builder may adopt an unsuitable solution or cover up a discrepancy. One result affecting structural safety may be reduced bearing area; for example, in brick cladding which is built plumb on a continuous corbel varying in line and level.

The forthcoming British Standard Code of Practice 'Accuracy in Building' and other information published by the Building Research Establishment provide a good basis for understanding; but until more experience is gained in setting, communicating and controlling tolerances in building, there remains a risk that errors and misunderstandings will occur. The tendency in the building industry to use standard specification clauses adds to this risk in that tolerances which are vital may receive no more attention than those which are desirable.

2.11 RESPONSIBILITIES OF LOCAL AUTHORITY INSPECTORS

The House of Lords gave judgement in Anns and Another v Merton, London Borough Council that:

"if a local authority elects to exercise its powers to inspect a structure, it has a duty of care in inspecting the structure properly. The liability for a defect runs from the time of discovery of that defect; statutory duty does not exclude common law responsibility."
The Committee's attention was drawn to the possibility that this judgement might have the effect of dividing responsibility. For example, in private house building the work might be inspected by the architect, the National House Building Council representative and the local authority inspector; with unclear responsibility, the quality of inspection may suffer.

The Standing Committee considers that some clarification of the professional responsibilities and duty of care of individuals involved in inspection work of this type would be helpful. (See Appendix 1).

2.12 THE STRENGTHENING OF REINFORCED CONCRETE BRIDGES BY ATTACHMENT OF RESIN BONDED STEEL PLATES

Following publication of a method of strengthening bridges on the M20/M25 interchange at Swanley in Kent, the Standing Committee corresponded with the Department of Transport to enquire about:

(i) the design justification for the method including the factors of safety which had been applied for both serviceability and collapse limit states;
(ii) the method proposed for monitoring performance of the repair method.

The Standing Committee was satisfied that the Department of Transport had taken appropriate care in this case to reduce the risk of peeling or shear failure in the resin bonding and that the performance of the strengthening would be monitored carefully. However, the Committee is concerned that publication of the method might well have encouraged others to regard it as proven for any similar application.
The Standing Committee wishes to draw attention to their opinion that this method of strengthening requires further research and monitoring over a period of years before it can be recommended for general use.

2.13 DAMAGE TO BRIDGES THROUGH IMPACT BY HIGH VEHICLES AND HIGH LOADS

The Standing Committee drew attention in its first annual report to the incidence of damage to bridges through impact by high loads and recommended some measures which could be taken by the Department of Transport to reduce the risk. The most serious danger is to railway bridges of metal girder or brick arch construction and to footbridges over highways. The vehicles most frequently involved in serious incidents are container lorries, lorries carrying refuse skips and low loaders carrying contractors plant. A particular problem is posed by poorly secured plant, especially those with hydraulic jibs or other moving parts, which have a tendency to rise during a journey.

The Secretary of State for Transport was informed of the Committee's concern which was subsequently endorsed by the three Presidents. Among the actions urged were amendment of the construction and use regulations to include a height limitation on vehicles and their loads and the need to make provision in new bridge works (including footbridges) against collapse due to vehicle impact. The Secretary of State has informed the Presidents that his Department is implementing six of their seven recommendations; the exception being the introduction of a statutory height limit for vehicles.
From the evidence the Committee has received, there appears to be a significant number of bridges which have a clear height of 4.95 m (16 feet 3 inches) or more being struck by high loads. Regulations would certainly help in solving this problem and also make operators think about the height of loads to be moved and appropriate routes. The suggestion of a prescribed height limit is completely analogous to the regulations on weight limits, which appear to have worked extremely well.

The suggestion for a statutory height limit for loads of 4.95 m would place bridges into two basic categories: (1) those designed to accommodate all loads below the statutory height limit; (2) those below the statutory limit on which the safe height of a load is indicated.

The procedure which the operator should follow would be the same for height as it is for weight. Any load above the statutory limit would have to be notified and a prescribed route laid down. In respect of lower loads no notification would be necessary but the duty would rest with the operator to ensure no collision with bridges in category (2). The problem has been drawn to the attention of the Federation of Civil Engineering Contractors, National Federation of Building Trades Employers, and Contractors Plant Association.

The three Presidents have also suggested to the Secretary of State for the Environment that the problems of bridge clearances on approach routes should be taken into account when planning applications for new industrial developments are considered.

Note: 'Proposed Amendments to the Motor Vehicles (Construction and Use) Regulations 1978', issued for comment by the Department of Transport on 20 June 1978, covers many of the Committee's points.
3. COLLABORATION BETWEEN THE STANDING COMMITTEE AND OTHER BODIES

AMERICAN SOCIETY OF CIVIL ENGINEERS

In early 1977 the American Society of Civil Engineers (ASCE) received a research grant from the US Department of Transportation to set up a computerised Engineering Performance Information Centre (EPIC). EPIC is to collect and disseminate information on structural failures of all types, both to assist those involved in investigations and prevent foreseeable failures. The Standing Committee has established a helpful liaison with EPIC, receiving papers on subjects such as claddings which have helped to clarify and substantiate some of the Committee's findings.

BUILDING RESEARCH ESTABLISHMENT

The Standing Committee has maintained its contact with the Building Integrity Division (BID) of the Building Research Establishment. BID is to act as the UK contact point in an international early warning system on structural safety. Belgium, Denmark, France, Germany, Holland, Ireland and Italy have agreed to co-operate. The network will enable countries involved to inform one another of circumstances leading to risks of structural failure as soon as they become apparent.
4. PROPOSALS FOR THE YEAR COMMENCING 1 APRIL 1978

For the coming year, the Committee has already planned the following discussions but would always welcome suggestions on any additional matters requiring attention:

- The influence of welding on structural safety
- Safety implications of concrete admixtures
- Safety implications of post-tensioned pre-stressed concrete
- Building problems in relation to structural safety

In addition, it will continue to investigate some of the topics listed in Section 2 and deal with other matters presented to it.
APPENDIX 1 STATEMENT ON DUTY OF CARE AND PROFESSIONAL RESPONSIBILITY

It is not possible nor appropriate for the Standing Committee to define duty of care and professional responsibility in any detail. Apart from cases where there can be shown to be breach of contract, this is a matter largely based on the Common Law of negligence, which is being developed from day to day by the Courts. The following are some general principles of the law, as it stands at present, which may help to clarify the position in regard to negligence.

Duty of Care
The professional person has a duty, just as much as anyone else, in the particular circumstances to exercise reasonable care to avoid acts and omissions which can be reasonably foreseen to be likely to cause physical or financial injury to persons or property. Negligence is failure to exercise that care.

The practice of a profession, art or calling which, by its nature, demands some special skill, ability or experience, carries with it a duty to exercise, to a reasonable extent, the amount of skill, ability and experience which that practice demands. If a person professing to practise such a profession, art or calling fails to possess that amount of skill, ability and experience which is usual in that profession, art or calling or if he neglects to use the skill, ability and experience which he possesses or which is demanded or professed, he will be liable for breach of duty. This duty is owed not only to those parties with whom he has contractual arrangement, e.g. by whom he has been employed or consulted, but also to all persons who are so closely or directly affected by the negligent act that they ought reasonably to have been foreseen as likely to suffer from that act.

Duty of care thus arises where there is such proximity between two persons that the negligence of one is likely to affect the other injuriously.
Liability to Damages

Liability attaches to negligence not only where it is the sole effective cause but where it is also a contributory cause of an injury.

Negligence of a professional person thus gives rise to liability under Common Law in tort, apart from the more obvious liability for breach of contract. Where an employee is negligent, both he and his employer will normally be liable. A person who has been sued for negligence, although liable himself, may in some circumstances, be able to pass on his liability to someone else (e.g. an independent contractor or a professional man who is actually responsible for the particular negligent act).

In all cases, it is for the courts to decide who, if anyone, is liable. The position in any given case will depend on the particular facts and circumstances of that case, and the taking of legal advice should be considered as soon as any serious question of liability seems likely to arise. Those who are interested would do well to read the Judgement in Clay v Crump & Son Ltd. (1964)1QB 533, a decision in the Court of Appeal on the liability of an architect and demolition contractors to the foreman of building contractors who was injured by the fall of a wall left standing through the negligence of the architect and building contractors in question. This case gives a comprehensive statement of the present law of negligence in the field of building operations, and shows how it has been developed and widened over recent years to protect innocent third parties.

APPENDIX 2  TERMS OF REFERENCE

To study trends and innovations in design, construction and maintenance of structures from the safety standpoint.

To consider where further research and development work, or some warning of risk, appears desirable from the safety standpoint.

To report to the three Presidents and to make recommendations.

To produce an annual report on its activities.

To seek, receive and authorise the expenditure of funds necessary for the implementation of these terms of reference.

To suggest to the three Institutions any changes to its terms of reference it considers to be necessary or desirable.
APPENDIX 3  LIST OF MEMBERS

CHAIRMAN:  The Rt Hon Lord Penney OM KBE MA PhD DSc FRS

S L Bragg MA MSc CEng FIMechE FRAeS  
Vice-Chancellor & Principal, Brunel University

C D Brown BSc CEng FICE  
Mott Hay & Anderson

J A Derrington BSc(Eng) DIC CEng FICE FIStructE  
Sir Robert McAlpine & Sons Ltd

A Gordon CBE LLD DipArch PPRIBA  
Alex Gordon & Partners

The Hon Mr Justice Graham  
High Court Judge (Chancery Division)

Professor E F Happold BSc CEng FICE FIStructE  
University of Bath

D N Rogers BScTech CEng FICE FIMunE  
City Engineer, Birmingham

R E Rowe CBE MA ScD CEng FICE FIStructE FIHE FASCE  
Cement and Concrete Association

A C E Sandberg BSc ACGI CEng MConsE MIMechE MIHE  
Messrs Sandberg & Partners

R L Triggs BSc CEng FICE  
Edmund Nuttall Limited

F Walley CB MSc PhD CEng FICE FIStructE  
Property Services Agency, Department of the Environment

SECRETARY:  L S Blake BSc(Eng) PhD CEng FICE FIStructE FIHE  
CIRIA

TECHNICAL OFFICER:  *J C Mason MA CEng MInstuctE  
CIRIA

*until February 1978
APPENDIX 4 STATEMENT OF COSTS AND ESTIMATES FOR 1978/1979

Summary of expenditure for the twelve month period 1 April 1977 to 31 March 1978

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
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<tbody>
<tr>
<td>CIRIA staff time and overheads</td>
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<td>Committee expenses</td>
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<td>£9,053</td>
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<tr>
<td>VAT @ 8%</td>
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<td><strong>TOTAL</strong></td>
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Budget for twelve month period 1 April 1978 to 31 March 1979

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIRIA staff time and overheads</td>
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<tr>
<td>Committee expenses</td>
<td>£900</td>
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<td></td>
<td>£9,957</td>
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<tr>
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<td>£796</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>£10,753</strong></td>
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