OECD Centre for Effective Learning Environments (CELE)

International web conference seminar series

"Standardised design" for schools

Old solution, new context?

OECD

CELE

Introduction

"Can standardised design provide a flexible solution for school planning and management?"

"Standardised design" can cover many aspects of the design of a school, or any other type of building. Standardisation can take place at many levels from processes, dimensional co-ordination of buildings, components, assemblies and modules. However, standardised design is often thought of in terms of "template" or "repeat" design, and in its most simplistic interpretation implies a singular design solution for widespread implementation, the principal benefits of which are time- and cost-savings.

The increasing demand for school places across OECD countries during the post-war period through to the 1980s saw "standardisation" in at least two forms as part of the remedy. One was the creation of standard school plans and another, the development of industrialised buildings systems, particularly in the 1960s and 1970s. From the early 1980s, as the volume of school building reduced, standardisation attracted less attention. However, it has returned to the agenda in recent years as economies have addressed a number of different issues from finding ways to construct buildings more efficiently by using off-site fabrication, to looking for ways of constructing buildings quickly and more cheaply. For example, template design was a feature of Australia's recent Building Education Revolution programme. In the UK, standardised design is one of the recommendations of the report into England's school building programme for the Department of Education by Sebastian James published in April 2011. This "Review of Education Capital" recommends that "a suite of drawings and specifications should be developed that can easily be applied across a wide range of projects". The report argues that this does not mean that buildings will all look the same, the designs can be tailored. The aim is to both improve the efficiency of the process of building many schools, but also to facilitate feedback into the design of education environments through periodic reviews of these standard designs.

Critics of "standardised design" cite it as being inflexible: It thwarts innovation and fails to address diverse educational and other needs of communities. However, there are examples from some countries that suggest that developing best-practice "standardised designs" and modular construction methods can be cost-effective, and reduce design and construction costs while producing a range of tried-and-tested educational environments that support teaching and learning. In the face of tightening budgets and increasing demand on governments to provide learning environments that support the development of 21st century knowledge, skills and attitudes, could standardised design be a model for the future?

On 30 March 2011, 10 members of the OECD Centre for Effective Learning Environments Board of Participants – representing Australia, Brazil, Belgium, Canada, Ireland, Mexico, New Zealand, Portugal and Serbia - participated in a live web video conference on "Standardised design: Applications and challenges" (see Annex 1 for a list of participants). The context, implementation and overall impact and benchmark for the future through using "standardised design" approaches in six different countries, in addition to drawings, photos and links to further information, are presented in this report.

Australia (Victoria): Using standardised school templates as a starting point for improved design

Context

In 2009, the Nation Building - Economic Stimulus Plan committed AUD 16.2 billion to modernise Australian school facilities through the Building the Education Revolution (BER) programme. In 2006, the Department of Education and Early Childhood Development (DEECD), Victoria – a state in south-eastern Australia with a population of over 5.4 million, including 853 121 school students - launched a programme to rebuild, renovate or extend 500 government schools in four years, with initial funding of AUD 1.9 billion. The BER programme further extended and accelerated modern learning designs, resulting in an additional 1 323 major construction and refurbishment projects in Victorian government schools. As of 28 February 2011, construction was completed for 582 out of 1 253 "Primary Schools for the 21st Century", and for 10 out of 70 "Science and Language Centres for 21st Century Secondary Schools".

Implementation

Standardised design in primary and secondary schools, including relocatable buildings, has a long tradition in the state of Victoria. In the last decade, schools have sought bespoke designs in an effort to better meet schools' unique needs, although this often resulted in the repetition of earlier designs. In 2007, DEECD developed a set of standardised designs for rural schools with enrolments of between 50 and 150 students. A simple construction process permitted any selection of designs to join up in multiple locations, resulting in reduced design and construction costs. This same process was applied to relocatable buildings.

In 2009, the announcement of BER as part of the economic stimulus package necessitated rapid spending, using local builders and labour where possible. To achieve this, DEECD drew on five years of "best practice" design experimentation to develop 34 templates for classrooms and libaries (Figure 1), multipurpose centres (Figure 2), gymnasiums, science centres and other facilities for different funding levels. The template designs:

- Promote active, student-centred learning for all students through flexible and functional spaces that support contemporary learning and teaching.
- Support student health and wellbeing, and promote positive social interaction between all students and staff.
- Comprise high quality, durable and adaptable buildings that can be expanded and reconfigured at a later time.
- Support integration of ICT into learning and teaching.
- Embed environmental sustainability principles.
- Actively promote the safety and security of students, staff and visitors and minimise security risks.
- Offer a range of spaces suitable for community use.

A number of designs for small school solutions using factory built methods were also developed (Figure 3). Currently, more than 90 small schools are being constructed using standardised design. These facilities are produced to a similar high specification in a short timeframe, then transported as modules to cranes on site, and assembled in four weeks.

Figure 1. Library and classroom 5. *This facility is configured around a centrally located learning resource centre with zones for online learning and small performance and presentation. Six ICT rich home bases link to the central resource centre. Spaces at each end of this facility enable community access, quiet reflection or creative investigation.*

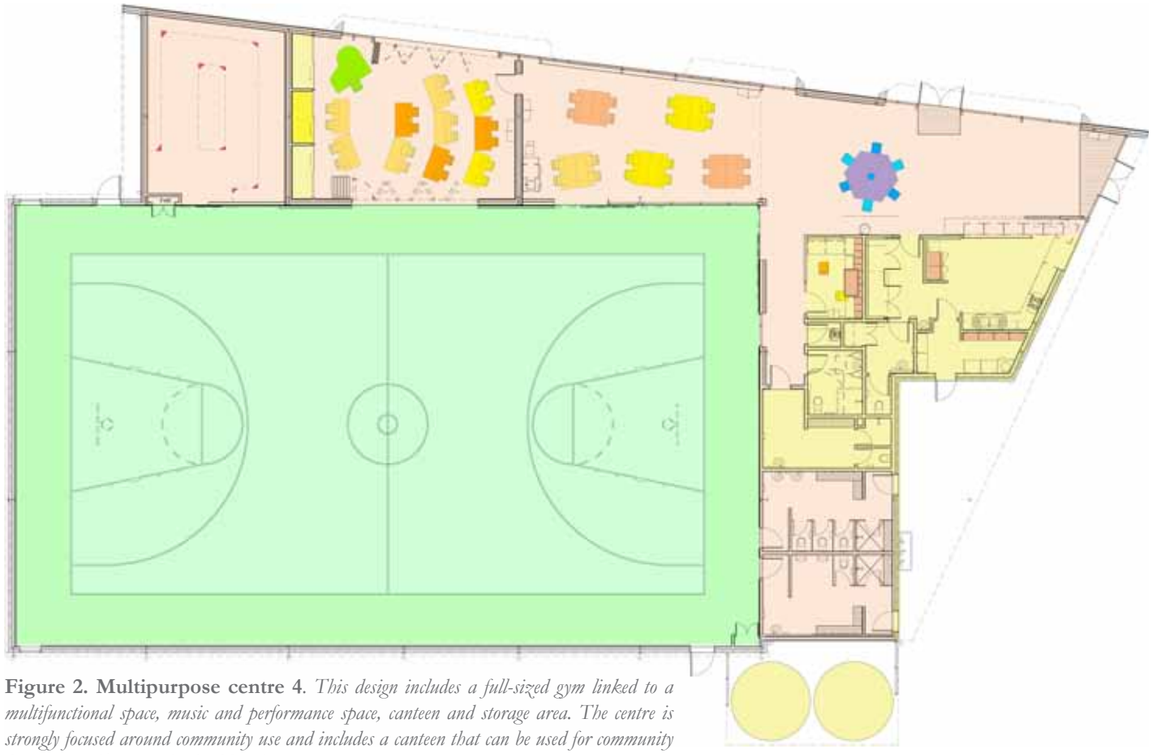

Figure 2. Multipurpose centre 4. *This design includes a full-sized gym linked to a multifunctional space, music and performance space, canteen and storage area. The centre is strongly focused around community use and includes a canteen that can be used for community functions and/or out of school hour's activities*

An evaluation of the educational effectiveness of all BER facilities in Victoria will be undertaken in 2011.

Overall impact and benchmarks for the future

- **Supporting teachers in their new environment.** A professional development programme is assisting teachers to use the new learning environment to best effect.
- **Providing options**. Design template can be used by schools as a starting point for bespoke design – these designs can be adopted either as whole or in part.
- **Providing models of best practice**. More schools are selecting template designs because they are models of "best practice" in educational spaces - and are relatively faster and more cost efficient to deliver.

For more information

- *Main BER page for Victoria, Australia*: http://www.education.vic.gov.au/buildingrevolution*Virtual tours of BER standard design templates (Multipurpose Centre, Library and Learning Neighbourhood, Multi Service Centre, Science Centre, Language Centre) in Victoria, Australia: http://www.education.vic.gov.au/about/*directions/buildingrevolution/aboutber/virtual_tours.htm
- *Overview of BER buildings and cost information:* http://www.education.vic.gov.au/about/directions/buildingrevolution/aboutBER/costings/building_view.htm
- *Publication,* Making the Most of Flexible Learning Spaces. A Guide for Teachers and Principals, *DEECD, Melbourne, 2011*. http://www.eduweb.vic.gov.au/edulibrary/public/govrel/ber/2011/berflexiblespace.pdf

Figure 3. Small school classroom 2. *This design includes three classrooms, a project space and administration area. This facility is manufactured offsite, which results in increased quality and minimal disruption to schools.*

Belgium (Flemish Community): Incorporating permanent modular building systems into school building policy

Context

The Agency for Infrastructure in Education (AGIOn) is a public institution under the supervision of the Flemish Minister of Education. AGIOn is responsible for subsidising, purchasing, constructing and renovating public and private educational buildings in Flanders. AGIOn does not subsidise all school building projects; the subsidy amounts to 70% for primary education and 60% for secondary education.

Recently, AGIOn was asked to look into standardised modular system construction solutions for school buildings (see Figures 4-7). Several building firms currently offer prefabricated construction systems to schools, presenting them as fast, sound and affordable solutions for replacing and extending school buildings. The schools themselves have some important questions about this issue: Are such systems eligible for subsidies? Do they meet the (fire safety, acoustic and energy performance, accessibility, etc.) guidelines, standards and regulations for school buildings?

On 3 May 2011, the Management Board of AGIOn approved an internal policy note on modular buildings, in which modular construction was defined as:

> *a construction [which] uses prefabricated construction components, such as floors partitions and roofs. These elements are added to the existing facilities on the building site. System construction uses not only prefabricated concrete products. Increasingly, other materials are used, such as wood (HSB-elements) and steel (skeleton elements). In system construction, frames are used for partitions and floors.*

The advantages of modular system construction are that controlled factory production is more likely to ensure the quality and condition of materials; and construction, finishing and occupation of the building are much faster. On the other hand, less attention and time may be given to design quality and to meeting the specific needs of the client. To ensure profitability, the plan must also be standardised, repeated and simple. Finally, manufacturers of contemporary system construction often meet only the minimum legal requirements concerning energy performance, fire safety, security, accessibility, etc.

There are two types of modular system construction: temporary or semi-permanent buildings - which often meet an urgent need for space and can be dismantled and moved easily - and permanent system construction, which are intended for longer periods of use and employ prefabrication construction methods, for example walls, roof, floors are manufactured in the factory can be assembled as separate elements on the school site.

Conditions for implementation

The policy note also states that in specific situations, permanent modular buildings can provide functional, durable school buildings. AGIOn thus considers permanent modular system construction eligible for subsidies, provided the construction adheres to a set of existing guidelines, standards and regulations for school buildings.

As funds are scarce and the waiting list for subsidies is long, it is expected that permanent modular building systems will be promoted as a fast alternative to container classes and minor expansions to school buildings (Figures 4-7). As part of a quality, sustainable school buildings policy, AGIOn will play a supportive and advisory role for schools wishing to apply for subsidies for modular building systems. AGIOn gives extra support for the following reasons:

Figure 5. *Example of a school using a permanent modular building system. Photo credit: ALHO.*

Figure 4. *Example of a school using a permanent modular building system. Photo credit: ALHO.*

- System construction is frequently chosen because of good cost-benefit balance, thereby increasing the risk that the important predesign phase and/or the quality and sustainability of the final product may be compromised.
- A construction system must support the educational programme and vision of the school - not the other way around. Each school building project must strive for the most durable solution. Mutual consultation and interaction between contractors, architect and clients is essential. System construction requires, like any other building project, a good building brief and project definition, the involvement of an architect, a design vision and a focus on longer term issues such as flexibility, maintenances and management costs.
- Within the framework of sustainability, aspects such as permanent architectural value, sustainability of construction material, attractiveness, comfort, and a good balance between costs and benefits must also be considered. These all require extra effort in the design and implementation phases, and it is questionable whether such a construction system can fulfil all these objectives.
- Experience with permanent system construction in schools has been very limited in Flanders. Like any new construction method - such as passive building, E70 and public-private partnerships - each application for subsidies requires careful consideration.

Implementation

To ensure a sustainable, high quality modular building that is responsive to the needs and wishes of the school and the conditions of AGIOn for granting subsidies, AGIOn will offer free support and advice on the use of modular building systems for building projects involving both new construction and expansion works. AGIOn offers a consultation meeting prior to the submission of the application for subsidies. The objectives of this meeting are to:

- Present the issues relating to modular system building systems.
- Assist schools to prepare good project briefs as part of their application.
- Support and advise the school on the preliminary design.
- Make recommendations and provide additional references, where necessary.

For more information

- www.agion.be
- www.scholenbouwen.be

Figure 6. *Example of a school using a permanent modular building system. Photo credit: ALHO.*

Figure 7. *Example of a school using a permanent modular building system. Photo credit: ALHO.*

Canada (Alberta): Rejuvenating standard school designs with modular classrooms for the 21st century

Context

In 2005, the Government of Alberta (Ministries of Education and Infrastructure) began exploring the possibility of using a standard core design concept for schools as a way of addressing issues of increasing costs, ensuring equity between school jurisdictions and speeding up the delivery of much-needed school infrastructure to accommodate the province's rapidly growing student population (Figures 8 and 9).

The study concluded that significant savings in both time and cost could be achieved over the life of the school facilities by using standard core school designs combined with high-performance factory-built modular classrooms, which would allow schools to expand capacity in times of high enrolment and then be redeployed to address needs at other schools when no longer required.

Past attempts to created standard school designs in Alberta had not been successful. The designs could not adapt to the unique requirements of school jurisdictions' particular educational needs, site conditions, and local by-laws. The core/modular school design concept allows sufficient flexibility to address these concerns.

Portable classrooms had also been used in Alberta for many years but had been viewed mainly as temporary solutions to enrolment pressures at specific schools. In 2004, a province-wide programme was initiated to procure quality factory-built classrooms with service life and performance characteristics similar to the permanent sections of receiving schools. The "standard core design with modular classrooms" concept makes re-locatable classrooms an integral and intentional part of Alberta's plan for the provision of cost-effective, adaptable school facilities.

Figure 8. *Core school design in Calgary - K9.*

Implementation

In 2007, design consultants, under contract to the Government of Alberta, created standard core school designs for three sizes of elementary schools and two sizes of kindergarten to grade 9 schools.

In 2009, two additional standard core school designs were approved for two sizes of grades 5 to 9 schools (also called middle schools).

The permanent core building contains the essential elements of a school such as the gymnasium, administration area, library, washrooms, storage, specialty ancillary spaces and a limited number of permanent classrooms. Modular classrooms are then attached to the core to provide the optimal-sized facility for the student population (Figure 10). Modular classrooms can also be removed and relocated to other schools as needed (Figures 11 and 12).

School jurisdictions using the standard core designs still have the flexibility to implement design modifications to address their specific educational programming needs, generally within the building footprint. For example, if a school is focused on a fine arts programme, more area within the building footprint can be assigned toward this use.

All of the designs achieve Leadership in Energy and Environmental Design (LEED) Silver Certification, resulting in 30% to 45% more energy efficiency and the provision of healthier learning environments with improved air quality and natural light.

These designs were subsequently used in the Alberta Schools Alternative Procurement (ASAP) initiative, a public-private partnership approach to school construction and maintenance. ASAP Phase 1 resulted in the completion of 18 new schools in 2010, all using standard core school designs. The use of these designs facilitated the ability to complete a "bulk procurement" approach under a public-private partnership and resulted in the Alberta government saving CAD 97 million as well as delivery of the schools two years earlier compared to a traditional build approach.

Figure 9. *Core school design in Edmonton - K9.*

Figure 10. *Modular classrooms on a core school in Edmonton.*

Overall impact and benchmarks for the future

Because Alberta has only recently begun implementing core school designs, and opened the first 18 schools less than a year ago, actual performance of the schools is still being assessed. Anecdotally, responses from the school community, parents, students and teachers have been extremely positive. In order to obtain a more in-depth assessment of how well the schools are performing, Alberta is undertaking a series of Post Occupancy Evaluations (POEs) of schools that were built using these designs. The first of these assessments began in March 2011 and three recently completed elementary schools in Edmonton and Calgary will be reviewed. The POEs will examine the buildings in terms of both facility performance and educational functionality.

One of the other key lessons learned is with respect to involvement of the school jurisdictions in the process of developing the standardised designs. The first few designs to be completed did not include significant input from the stakeholder community and as a result, acceptance of the designs was not as great as had been hoped. In the development of subsequent designs, school jurisdictions added significant value to the process and substantially, which increased the support for use of the standard core designs.

Another important factor in the acceptance of the designs was the flexibility afforded to school jurisdictions to work with a "bridging architect" to modify the standard core designs to meet the specific educational programming needs of each school jurisdiction. Dedicating sufficient resources to this work was key in achieving an outcome that was supportable by the school jurisdictions.

In Alberta, use of standard core designs still has some detractors, both in the architectural community and with school stakeholder groups. However, on balance, it is becoming more accepted, in part because it provides the ability to address rapidly growing enrolments and the critical need for new schools in a timely manner. Standard core designs are recognised as a means to significantly increase the speed at which new facilities can be delivered with the resulting trade-off being reduced design flexibility.

For more information

- *Seven designs for standard Kindergarten to Grade 6, Kindergarten to Grade 9 and Grades 5 to 9*. http://education.alberta.ca/department/ipr/p3project/standard.aspx

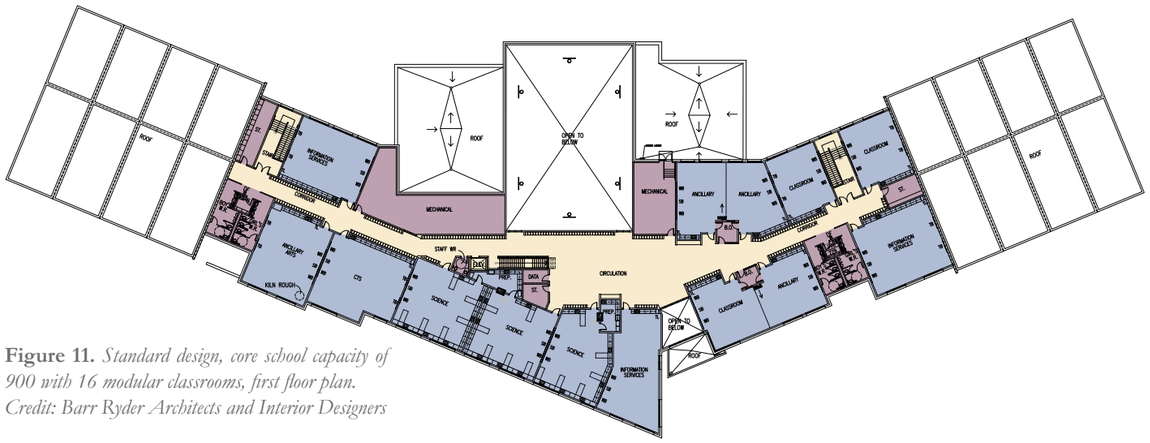

Figure 11. *Standard design, core school capacity of 900 with 16 modular classrooms, first floor plan. Credit: Barr Ryder Architects and Interior Designers*

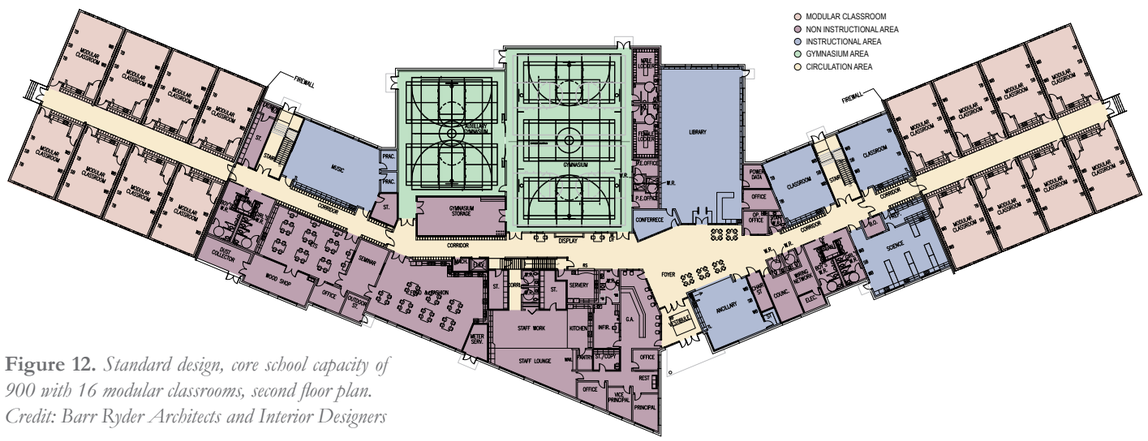

Figure 12. *Standard design, core school capacity of 900 with 16 modular classrooms, second floor plan. Credit: Barr Ryder Architects and Interior Designers*

Ireland: Standardised "expandable" schools for a rapidly growing population

Context

Since 1860, when the first one-room standard school plan was developed for public schools in Ireland, standard school plans have been used to provide a quick solution to accommodate burgeoning school-age populations. In 1955, for example, the first standard school plan for 100 students was developed for public schools (see back cover).

Implementation

The main focus of the "Schools Modernisation and Development Programme" – developed and implemented by the Department of Education and Science, Ireland, as part of the National Development Plan (2007-2013) – is the provision of additional school places in rapidly developing areas.

The actual number of classrooms required for this period will depend on such factors as the spread of additional students and the capacity, or otherwise, of existing schools to meet this demand. There is a continuing need to ensure sufficient investment in school buildings to address demographic need. For example, at primary level the expected increase of approximately 57 000 students by 2018 could necessitate the provision of up to 2 050 additional classrooms, which – if students cannot be accommodated in existing facilities - equates to roughly 125 new schools of 16 classrooms, costing a total of approximately EUR 375 million. Over the next four years, the multi-annual allocation aims to invest EUR 2 800 million in the nation's first and second level schools.

Programme delivery strategies include:

- Pro-active planning through close and regular engagement with local authorities.
- A partnership approach with local authorities to deliver community facilities in co-operation with new schools.
- The active participation where possible of school management authorities.
- Early involvement in education provision in strategic development zones.
- Publication and implementation of area development plans.
- Use of Generic Repeat Designs (GRD) and Design & Build contracts for new primary schools. The Department is open to trying innovative school delivery methods, especially those that results in reduced waiting times for permanent school accommodation.

To date, 25 GRD designs have been completed, 8 are in the construction phase and 11 are at the tender stage. There are four basic GRD designs:

- 8-classroom two-storey schools, in which the hall and support facilities form the core of an expandable school (Figures 13 and 14), with optional north and south main entrances (Figure 15).
- 12-classroom two-storey schools, with south and east facing classrooms and optional north and south main entrances (Figure 16).
- 16-classroom 2-storey schools, with a compact plan in which the General Purpose Hall is nested between the L-shaped classroom blocks (Figure 17). The low external wall surface to floor area ratio results in less heat loss through the building fabric and reduction of service distribution lengths.
- 24- to 32-classroom schools, recently developed in response to an increase in student numbers in emerging new communities in rapidly developing areas. These schools are about to go to tender.

Overall impact and benchmarks for the future

The overall energy impact of the design is considerable as more than 50 schools, with a total value of approximately EUR 170 million, will be constructed to this proven and optimised, low energy design.

The generic prototype is the Department's benchmark for primary school accommodation for at least the next few years. They have also been used as templates for fast-track delivery Design & Build modular schools. As a proven low energy solution, it will drive future research forward closer to zero or neutral carbon buildings. As schools within communities they have a wider educational role in environmental awareness, and demonstrate government commitment to a sustainable future.

Figure 13. (left) *South- facing 2-storey classroom block and entrance of first completed Generic Repeat Design (GRD) National School, Archbishop Ryan, Balgaddy, Lucan, Co. Dublin, Ireland.*

Figure 14. (right) *The hall, which forms part of the core GRD.*

For more information

- *Publication*, Generic Repeat Design Schools, *Planning and Building Unit, Department of Education and Science, Ireland, 2006*. http://www.education.ie/servlet/blobservlet/pbu_generic_repeat_design_schools1_2.pdf
- *Publication*, General Design Guidelines for Schools (Primary and Post-primary), *Planning and Building Unit, Department of Education and Science, Ireland, 2007*. http://www.education.ie/servlet/blobservlet/bu_tgd_020.pdf
- *Publication*, Primary School Design Guidelines, Revision, *Planning and Building Unit, Department of Education and Science, Ireland, 2010*. http://www.education.ie/servlet/blobservlet/bu_tgd_22a.pdf
- *General information on "Primary and Post-Primary Design Guidance":* http://www.education.ie/home/home.jsp?maincat=&pcategory=17216&ecategory=54380&sectionpage=12251&language=EN&link=link001&page=1&doc=50432

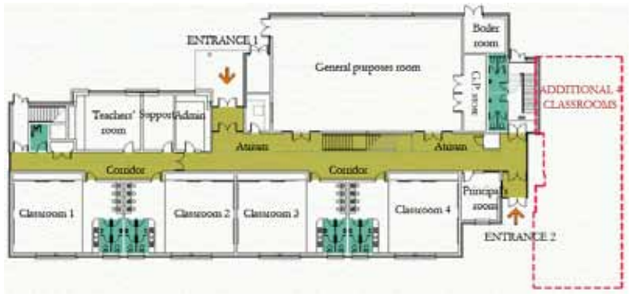

Figure 15. *Ground floor plan of 8-classroom GRD school.*

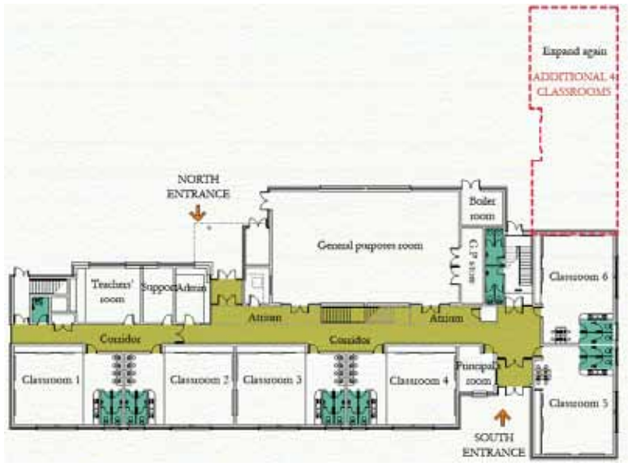

Figure 16. *Ground floor plan of 12-classroom GRD school showing ease of expansion.*

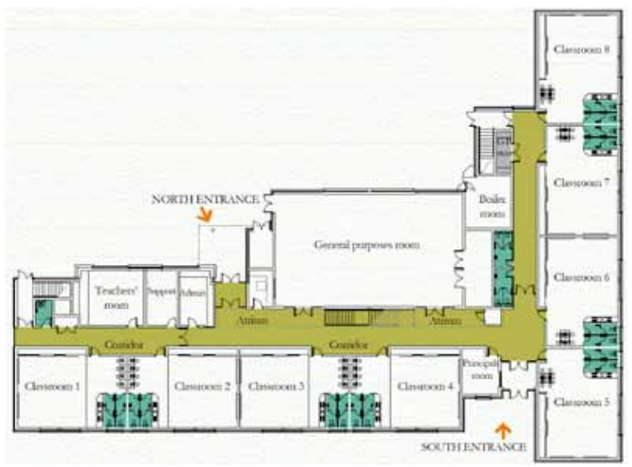

Figure 17. *Ground floor plan of 16-classroom GRD school.*

Mexico: Some reflections on standardised design from recent past experience

Addressing issues of quantity in schools in Mexico in the 1960s and 1970s

With a total area of 1 972 500 km^2, Mexico currently has a population of 108 700 000 and approximately 184 500 schools.

In 1959, the Mexico Secretariat of Public Education (SEP) adopted the National Education Plan (1959-1970). Its main objective was to enrol thousands of children who did not have adequate access to educational services. The Plan included, *inter alia*, the development of new curriculum, teacher training and the construction of 54 000 classrooms.

The scale of the Plan necessitated the development of typical plans. To meet this challenge, the Administrative Committee of the School Construction Federal Programme (CAPFCE) developed an original building system based on a tri-partite participation between the Federal government (CAPFCE), the State (31 States and 1 Federal District) and the community. The Federal government (CAPFCE) provided:

- A lightweight metallic structure. Each element was bolted, earthquake resistant and weighted no more than 25 kg so that the structure could be carried by two persons.
- Plastic windows with pedagogical topics (geography, biology, etc.) that could be easily changed by the teacher.
- Timber furniture, designed for easy repair.

The State and the community provided the site, foundations, labour and local materials for the walls and roof.

The building system was a lightweight structure, with one-direction growth: 3 m distance between columns and a span of 6 m which grew in size as the country developed its industry and pedagogical innovations. Over the course of the Plan, 54 000 classrooms were constructed and furnished.

From 1965, CAPFCE organised in each State a Branch (Zone Office) that worked with the States and communities, defining priorities and yearly construction programmes.

CAPFCE continued to develop prefabricated – such as welded metallic elements, windows and furniture - and other building systems – such as reinforced concrete structures, one-, two-, three-storey buildings - thus allowing cost and time reduction. At the same time, CAPFCE continued to produce:

- Typical plans for different spaces (classrooms, laboratories, workshops, administration, etc.) for different levels of education and enrolments (Figures 18 and 19).
- Typical schedules of accommodation for different levels of education and enrolments, including pre-school, primary, general secondary, technical secondary, middle secondary, technological institutes, teacher training institutes, boarding schools, etc (Figures 20 and 21).

These typical plans and schedules of accommodation enabled the definition of different building blocks, for different levels of education and enrolments, which provided a great variety of layouts ("typical model") that could easily be adapted to each specific site. One of the principal objectives of construction was to use locally available materials. CAPFCE also produced catalogues for the different typical models and levels of education, containing:

- All necessary architectural drawings.
- Detailed working plans for each type of space: classrooms, laboratories, workshops, etc.
- Detailed working plans for each type of space according to different building systems.
- Detailed list of furniture and equipment for each type of space.
- Mechanical guides for each typical model: electricity, sanitary, hydraulic, gas, and special installations;
- Site guidelines, including characteristics of the site, dimensions, location, orientation, etc.
- Building materials specifications: walls, floors, roofing, etc.

Figure 18. *Examples of primary schools in Mexico*

Figure 19. *Examples of secondary schools in Mexico*

The use of typical plans, which were composed of small modules, enabled Branch offices to develop rapid and flexible site layout plans based on the topography of the site. This facilitated rapid construction bidding as working drawings and lists of furniture and equipment were already in hand. All Branch offices were provided with a large quantity of catalogues, representing several years of work and good management on the part of CAPFCE to its Branch offices, thus facilitating the implementation of yearly construction programmes.

Addressing issues of quality in schools in Mexico today

In Mexico, decentralisation commenced in 1995, when funding for coordinating and constructing school facilities was passed from the Secretariat of Education (SEP) directly to the States, thus enabling states to better meet the objectives of the "1992 Agreement for the Modernisation of Basic and Middle Education". In 1998, CAPFCE was decentralised to the States ("Federalisation"), which became responsible for the construction of their primary and secondary schools. States were allowed to establish their own "school building construction organisms". In 2008, CAPFCE transformed itself into a research, regulatory and monitoring body, known as National Institute of Educational Physical Infrastructure (INIFED). INIFED is responsible for federal construction programmes in some States and in the Federal District, as well as other special building programmes.

Experiences in Mexico have demonstrated that "standardised design" is not only about developing typical floor plans; it is an intensive process involving preparing drawings and lists of furniture and equipment, etc., which requires a good co-ordinating and monitoring body. As Mexico today faces issues relating to ensuring sufficient *quality* of educational spaces, there is a need to maintain and modernise existing building stock, as well as providing thousands of new educations spaces each year that respond to educational innovation, information and communication technologies, and the aspirations of communities. Within the current context of decentralisation, States are well equipped with architectural and technical documentation, and educational facilities design in States and communities are increasingly reflective of local context and identity.

For more information

- www.inifed.gob.mx.

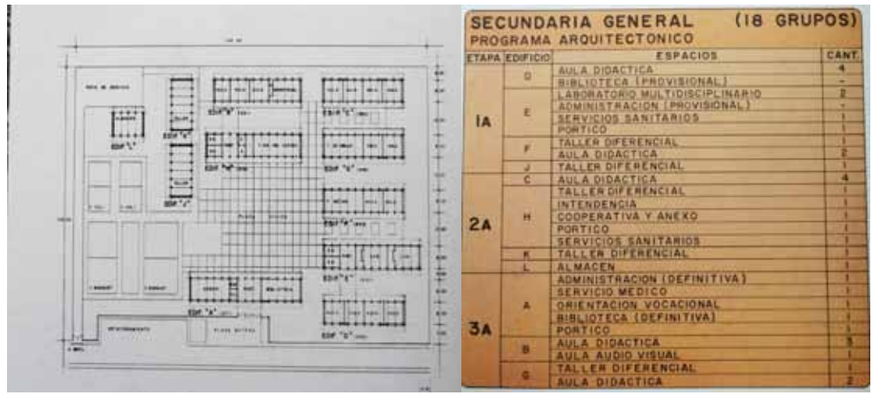

Figure 20. *Example of layout of a general secondary school for 18 groups and typical schedule of accommodation.*

Figure 21. *Example of layout of a technical secondary school for 18 groups and typical schedule of accommodation.*

Portugal: From repeated designs to modern individualised design solutions

Standardisation in design concepts and the project-type: 1960s to 1980s

In the 1960s, large secondary, technical and so-called preparatory schools for the 5th and 6th grades were constructed in the main cities of Portugal using repetitive solutions, which were characterised by modular design and standardisation of components that allowed for pre-fabrication. These schools were designed using the concept of multiple pavilions (*pavilionar)* (Figure 22). This represented a rupture with the previous tradition of the single large building, which had been built in Portugal since the 1800s.

At the end of the 1960s, the development of modular design using the *pavilionar* concept led to the so-called project-type and - with a small number of standardised designs - a large number of schools were conceived as highly practical solutions for rapid and economical execution.

This trend continued in the 1970s, resulting in the construction of preparatory schools - which became mandatory resulting in a significant increase in enrolments - and secondary schools.

The standard designs used light modular components to allow for more efficient assembly *in situ,* and some included concrete visible structures in their architectural composition (Figure 23). These standard designs were structured on the basis of a set of autonomous blocks - connected by covered exterior passageways - , allowing for adaptation to diverse conditions with regard to topography, solar exposure and accessibility (Figure 24).

Design for industrialised systems and back to the traditional in the 1980s and 1990s

In 1986, the Education System Act established nine years of basic and compulsory education, resulting in a rapid increase in enrolments and demand for educational spaces. To address this issue, the Ministry of Education continued to develop the *pavilionar* concept in new standard designs using industrialised construction systems, resulting in a more rapid and cost-effective process (Figure 25).

Elements from a typology of previously defined "models" were combined to create "blocks" of different educational spaces to compose a complete school programme, which corresponded to a defined "model" and which contractors could deliver quickly and efficiently through their construction systems. A "model" was defined based on the required level of education and a size on the number of enrolments. For workshops and canteens, special blocks were designed with one storey only. The blocks, designed within a modular grid using pre-fabricated construction components, had two possible sizes and featured two storeys in a square layout. The staircase was located in the central atrium, topped by a roof lantern.

Figure 22. *Trofa Secondary school, an example of 1960s* pavilionar *construction, demonstrating the beginning of standardisation concept in the design.*

Figure 23. *The aesthetics of concrete: example of 1970s construction and the standardised design concept, Preparatory and Secondary School Roque Gameiro Amadora, Portugal.*

In the 1990s, pre-fabricated systems were replaced by traditional construction, which proved to be cheaper. But the *pavilionar* model concept persisted as standard design and continued to be repeated all over the country for the next decade (Figure 26).

At the end of the 1990s, these repeated designs were abandoned as local municipalities were encouraged to develop individual solutions. In 2007, Parque Escolar EPE, a federal agency, was estabilised to allocate funding and provide design guidance to schools as part of a programme that is currently modernising all secondary schools in Portugal (Figure 27).

Figure 24. Pavilionar *and standard design concept in the seventies, Preparatory and Secondary School Roque Gameiro Amadora.*

Overall impact and benchmarks for the future While standardisation addressed the problem of providing *quantity* of accommodation in the 1980s, over time these schools were not able to meet requirements of *flexibility* and *quality*. Recent decentralisation of responsibilities for school buildings has afforded local municipalities greater input into decisions relating to pre-school and primary school design and construction.

In fact, in 1999, as a result of the decentralisation policy (Decree Law 159/1999 14th September), the local authorities (LA) were granted some competences for funding and spending on education, which include the construction, maintenance, equipment and running of pre-schools and first cycle schools assets. In 2008 these measures were reinforced (Decree Law 144/2008 28th July), and some local authorities also became

Figure 25. *Pavilionar, pre-fabricated model, example of 1980s construction, Secondary School of Linda a Velha*

Figure 26. *Traditional construction with standardised design blocks, an example of 1990s construction.*

responsible for the construction, furnishing, equipment and maintenance of second and third cycle school assets. LAs could also promote the creation of new schools or the modernisation or conversion of existing ones.

Parque Escolar design strategy is based on a "customised solutions model". By empowering school bodies from the pre-design stage and encouraging the early engagement of school boards in the decision making process, Parque Escolar recognises the users' role in identifying needs. As a result, the final solution is not a standardised one, but rather one which is discussed and approved by the school community, reflecting the educational project pursued by each school. Nevertheless, this implies an effective use of resources and cost control. This necessitates highly efficient solutions following criteria of suitability, robustness and cost effectiveness.

The design brief is defined according to a two-stage process. The initial one is defined by Parque Escolar and sets out the general principles that should be attended in the reorganization of all school buildings. It works as a conceptual matrix and is supported on a conceptual diagram that explains how this should be translated into building form. The key concept behind this matrix is based on two interconnected structural rings. A shallow one connects all the school spaces available to the community after school hours. A deeper one intertwines the teaching core with teachers' workspaces. These two rings intersect in the informal learning core space. The second stage incorporates each school educational vision. It corresponds to the customization of the conceptual matrix.

Parque Escolar also provides the designers' teams with design guidance and master specifications (concerning spatial layouts and technical solutions, as well as finishing materials and furniture) to be adopted. By providing rules and solutions to be followed along the design process, Parque Escolar aims to guarantee the coherence of operation and facilitate the design process, ensuring the quality of schools' facilities, while controlling construction and operating costs taking into account codes compliance and time criteria.

For more information

- *Publication,* Architectural Design Manual, *Parque Escolar, Lisbon, 2009.* http://www.parque-escolar.pt/admin/uploads/ManualProjecto_ARQUITECTURA.zip.

Figure 27. *Escola Secundária Dom Dinis, Lisbon, Portugal, constructed in 1970 with the standard design and using pre-fabricated components (at right). This photo shows a renovated block on the right and part of the school extension on the left, which was made in 2008 as part of the Secondary School Building Modernisation Programme in Portugal.*

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Photos on cover page: Artist's rendering of an Alberta core school design (Credit: Barr Ryder Architects and Interior Designers) (top of page); and interior and exterior photos of school from the Building Education Revolution programme in Victoria, Australia (bottom of page). Drawing on back cover: Standardised design for "National Schools" – or public schools - in Ireland from 1860 to 1964.