10 Years School Construction in Haiti

Technical Learnings From a Multiple Construction Program

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Edited by Livia Minoja

Infrastructure and Energy Sector

Education Division

Country Office in Haiti

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10 years

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Social Infrastructure

IDB

Photo: Ivan Bartolini (SDC)

About this publication

Created in 2017, the Social Infrastructure Unit (SIU) is a technical unit within the Infrastructure and Energy Sector (INE) of the Inter-American Development Bank (IDB). The SIU provides technical expertise to team leaders for the preparation, execution, and supervision of social infrastructure components included in the Bank's operations portfolio. The SIU also generates knowledge products to promote good practices in planning, procurement, design, construction, and supervision of social infrastructure.

This publication aims to present the technical learnings from the 10-year school construction program in Haiti (the Program), undertaken from 2010 until 2020 and financed by the Education sector of the Bank. The publication was written by Christian Ubertini[1], architect and SIU member, who has long been involved in the supervision of school construction activities and has documented important lessons learned. The publication was edited by Livia Minoja, architect and SIU member.

Credit for overall program achievements goes first to these Haitian counterparts that were responsible for implementing the activities related to the infrastructure component: The Ministry of Finance (MEF) and Ministry of Education and Professional Development (MENFP), for their collaboration and leadership; the national Executing Units (EUs); the Fonds d'Assistance Economique et Sociale (FAES); and the Unité Technique d'Exécution (UTE). Credit also goes to the private sector, stakeholders, service providers, construction firms, and the thousands of workers who had to carry out the work in a particularly difficult context.

Credit is also due to all IDB team members who along with their Haitian counterparts worked to design, launch, monitor and supervise the program during all these years, and in particular, the successive country representatives: Eduardo Marques Almeida, Agustin Aguerre, Koldo Echebarria, Felipe Gomez, and Yvon Mellinger; the Chief of Operations: Gilles Damais, Caroline Sipp, and Rafael Millan; Education team leaders: Sabine Rieble-Aubourg, Julien Hautier, Anouk Ewald, Annelle Bellony, Anne-Sophie Olsen, Alison Elias, Vladimir Mathieu, and Marie-Evane Tamagnan; technical experts Cristian Santelices for the guidance and key support provided during the first years of the program, Dany Tremblay for his engineering expertise, and Oscar Caviglia for the support provided to the EUs; and finally, to all those who, in one way or another, have contributed to the monitoring and supervision of the Program.

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The publication was edited by Livia Minoja, architect and SIU member.

1 Before joining the IDB, Christian Ubertini supported the Haitian Ministry of Education in developing new prototypes and guidelines for school construction, through a bi-lateral program financed by the Swiss Agency for Development and Cooperation (SDC). Ubertini first joined the IDB in 2013 as a "secondment" from the SDC, and since 2017, as a consultant.

Skyview of the school construction sites.
Source / illustration: Google Earth / Christian Ubertini (IDB)

Content

Photo: Christian Ubertini (IDB)

Abbreviations

ARSE / HA-L1049	1st EDU operation approved in November 2010. Appui à la Restructuration du Secteur de l'Education en Haïti.
AMOPERE / HA-L1060	2nd EDU operation approved in November 2011. Appui à la Mise-en-Œuvre du Plan sectoriel de l'Education et de la Reforme Educative en Haïti.
ACEQH / HA-L1077	3rd EDU operation approved in November 2012. Augmenter l'Accès à une Education de Qualité en Haïti.
APREH / HA-L1080	4th EDU operation approved in November 2014. Appui au Plan de Réforme de l'Education en Haïti.
DS + C	Design & Supervision + Construction (project delivery method)
DC + S	Design & Construction + Supervision (project delivery method)
D + C + S	Design + Construction + Supervision (project delivery method)
Decree 2014	Decree of 1st April 2014 by the Haitian MENFP validating new norms and standards for school infrastructure in Haiti, including prototypes and the "guide pratique."
ECD	Early Childhood Development (Preschool Education)
EDU	IDB's Education Division
EPT	Education Pour Tous. EU of the MENFP in charge of the execution of several soft activities included in the operations.
ESA / ESMP	Environmental and Social Analysis / Environmental and Social Mitigation Plan.
EU	Executing Unit
FAES	Fonds d'Assistance Economique et Sociale. EU in charge of the infrastructure component of the two first operations HA-L1049 and HA-L1060.
GoH	Government of Haiti
Guide pratique	Guidelines for school construction in Haiti also part of the reference documents validated by the MENFP (see bibliography)
IDB	Inter-American Development Bank
MENFP	Haitian Ministry of Education and Professional Development
MEF	Haitian Ministry of Finance
MTPTC	Haitian Ministry of Public Works
PDEF	Plan Décennal d'Education et de Formation (PDEF) 2020-2030, December 2020.
The Program	The Program refers to the infrastructure component of the 4 operations financed by the IDB (and donors) in Haiti, totaling 90 schools built from 2012 and 2020.
The Prototypes	School design prototypes and other reference documents elaborated to facilitate the execution of the school construction projects in Haiti.
SIU	Social Infrastructure Unit of the IDB
SMCEs	Small and Medium Construction Enterprises
UTE	Unité Technique d'Execution. EU in charge of the infrastructure component of the third and fourth operation (HA-L1077 and HA-L1080).

The National school of Délices in 2012 before its reconstruction by the Program.
Photo: Christian Ubertini (IDB)

Chronology

12 January 2010	Haiti experiences a 7.3 magnitude (Richter scale) earthquake. Approximately, 82% of the schools located in the affected regions are damaged or destroyed.
2010	Suspension of permanent construction by the GoH to revise building code.
2010	Approval of emergency funds under EDU Operation HA-L1040
April 2010	Installation of temporary structures in 58 schools by FAES HA-L1040
November 2010	New version of school norms by the MENFP establishing the 9+2 standards (9 classrooms for primary and secondary level + 2 classrooms for preschool)
November 2010	**1st EDU operation approved (HA-L1049, ARSE) including an infrastructure component of US$ 48,596,000 for the construction of 48 schools by FAES**
February 2011	First draft of new structural norms edited by the Ministry of Public Works.
November 2011	**2nd EDU Operation approved (HA-L1060, AMOPERE) including an infrastructure component US$ 23,438,000 for the construction of 24 schools by FAES**
2012	Publication of the Haitian National Building Code.
September 2012	Partnership between the IDB and the Swiss Agency for Development and Cooperation (SDC) including the secondment of a Swiss expert in school infrastructure to support the Education team in Haiti, until November 2016.
November 2012	3rd EDU Operation approved (HA-L1077, ACEQH) including an infrastructure component US$ 22,700,000 for the construction of 20 schools by UTE
April 2014	MENFP's decree establishing school construction standards, with prototypes, full set of construction documents and guidelines.
November 2014	**4th EDU Operation approved (HA-L1080, APREH) including an infrastructure component US$ 5,579,000 for the construction of 3 schools by UTE.**
December 2017	Closure of activities for the 1st (HA-L1049) and 2nd (HA-L1060) Operations.
October 2016	Haiti hit by Hurricane Matthew (classified as category 5 on the Saffir-Simpson scale). Nearly 4,000 schools in the affected regions are reported damaged or destroyed.
2017	Roof repairs in 75 schools affected by the Hurricane Matthew through EPT.
December 2020	Final disbursement date of 4th EDU Operation (HA-L1080)
September 2021	Expected final disbursement date of 3rd EDU Operation (HA-L1077)
December 2021	90 public schools, 1,024 classrooms (including 186 classrooms for early childhood education) reconstructed by The Program, providing a safe and comfortable learning environment for approximately 60,000 students each school year.

The historical School Elie Dubois constructed in 1913 rehabilitated by the Program.
Photo IDB

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- THEUNYNCK, Serge. (2010). Aide-Mémoire de la mission de la Banque Mondiale relative aux questions de génie-civil du 7-14 mars 2010. Note Technique.

Introduction

Interior of a classroom at the new National school of Argentine Bellegarde.
Photo: Alison Elias (IDB)

The National school of Chaudery in 2015 before its reconstruction by the Program.
Photo: MENFP / DGS

The National school of Layaille in 2012 before its reconstruction by the Program.
Photo: Christian Ubertini (IDB)

The Haiti school reconstruction program was part of the Government of Haiti's response to the massive reconstruction needs after the extremely damaging January 12, 2010 earthquake that struck Port-au-Prince and its surroundings. From 2010 to 2020, four operations[2] financed through the Haiti Grant Facility of the Inter-American Development Bank (IDB) plus seven co-financings[3] designed by the IDB Education division, and executed by the national implementing agencies, contributed to the reconstruction of the Haitian education sector as outlined in the Plan Operational (OP) of the Ministry of Education and Professional Development (MENFP) in 2010. These four IDB operations achieved the (re)construction of 90 public schools countrywide[4], which resulted in the creation of approximately 1,000 classrooms and 40,000 seats, providing a safer and comfortable learning environment for approximately 60,000 children each school year[5].

At the Program's onset in 2010, the education sector faced two main infrastructure challenges: a) a technical one— how to design and build cost-efficient schools that are both hurricane and earthquake resistant; and b) an operational one—how to identify a strategy that permits to up-scale construction countrywide while assuring quality and controlling costs. After 10 years of implementation, the technical challenge has been progressively overcome with the development and adoption in 2014 by the MENFP of a series of reference documents (i.e., prototypes, construction drawings, manuals, and guidelines) for quality and cost-efficient school construction, which have allowed the acceleration and coordination of project implementation to ensure quality and contain costs, as presented in the "BACKGROUND" section

The operational challenge has been more difficult to address, as it stems from structural factors inherent in Haiti, including: (i) technical and financial capacity of the construction sector; (ii) poor conditions to access rural areas; (iii) heavy centralization of resources and means; and (iv) weak institutional capacity to manage and steer large-scale construction programs. This situation required the project team to constantly adapt the implementation strategy to address the weaknesses observed during the different phases of project execution.

2 HA-L1049, HA-L1060, HA-L1077 and HA-L1080.

3 HA-G1024, HA-X1026, HA-X1027, HA-X1034, HA-X1032, HA-G1026, and HA-G1034.

4 Four TVET centres were also built within these operations, but they were not analysed in this publication, to focus the analysis on the multiple school's construction.

5 This is an estimation considering that many of these schools are functioning in double or triple shifts.

As a result, several options were explored and tested during this 10-year period with regards to project delivery methods, design preparation, and procurement strategy, as described in the "LEARNINGS" section.

This continuous search for improvement has produced many valuable lessons and experiences that are worth documenting and sharing, as they may be relevant to other contexts, and most importantly, to future emergency situations requiring large reconstruction of social infrastructure. They also lay the groundwork for a possible alternative strategy based on experiences and lessons learned, presented in the "UP-SCALING SCHOOL CONSTRUCTION COUNTRYWIDE" section.

This publication is not a program evaluation, but rather a summary of lessons learned for infrastructure projects in a country with an initially weak construction sector. This review does not speak to the soft components/ aspects included in the various operations, such as the improvement of education through teacher training, provision of teaching materials, and curriculum review, among others.

Even though the Program faced many challenges, 78 schools were successfully completed, and 82 schools were successfully completed, and 8 more are being finished at the time of publication. This accomplishment represents a successful result for the IDB's efforts and investment during the past ten years of work in Haiti.

August 2021 Earthquake

On August 14, 2021, while finalizing this publication, a 7.2 earthquake hit the southwest of Haiti causing death, and large-scale destruction of housing and infrastructure in the Grand'Anse, South, and Nippes regions. (1).

A first assessment of the fifteen schools financed by the Program and located within the affected area, was carried out in the week after the earthquake by IDB partners on the ground. According to this assessment, only one school (EN Aquin) suffered minor damage (mainly cracks on non-structural walls) that will be repaired (2). The other fourteen schools, some of which are located at the quake's epicenter, were not damaged and have been declared safe to open for the start of the school year in September 2021. While remaining cautious with the data and of drawing early conclusions, it appears that the Program's efforts to revise construction standards and to finance a qualitative reconstruction are beginning to bear fruit. The fact that students will be able to resume their schooling immediately after a major disaster and without interruption is likely one of the most significant and positive effects of the work done since 2010 on school infrastructure in Haiti.

(1) According to the Direction de la Protection Civile, the finaltoll amounted 2,248 dead and 12,763 injured, and 53,815 houses destroyed and 83,770 partially damaged. Additionally, 727 schools were affected (171 destroyed and 556 damaged). Source: Centre d'opérations d'urgence national, Rapport d'étape no 1, Rapport de situation no11, 4 septembre 2021.

(2) This school was part of the first group of schools ARSE 19 and was built before the adoption by the MENFP of new standards and prototypes.

Children at the National school of Duparc.
Photo: Christian Ubertini (IDB)

1. Background

Children walking to the nearest school in a remote and difficult accessible area
Photo: Christian Ubertini (IDB)

Children attending classes in a temporary location during the reconstruction of the National school of Duparc. Photo: Christian Ubertini (IDB)

The education sector after the 2010 earthquake

The January 12, 2010 earthquake, measuring 7.3 on the Richter scale, took the lives of more than 200,000 people and injured more than 300,000. The city of Leogane, located at the epicenter, was 80% destroyed. Haiti's capital, Port-au-Prince, was also heavily damaged and partially destroyed. According to the PDNA[6], a total of 105,000 homes collapsed and 208,000 were damaged. The loss of infrastructure amounted to US$4.3 billion, of which US$2.3 billion accounted for damage to the housing sector, and US$260 million (6% of the total) for education and health infrastructure. In the education sector alone, the MENFP stated that 82% of the schools (public and private), located in the affected regions, were damaged or destroyed (i.e., 6,000 schools damaged and 2,000 destroyed out of 7,300 schools located in the affected regions)[7].

For the education sector, this earthquake was part of a long series of disasters that regularly damage or destroy school infrastructure faster than the country can rebuild. Hurricanes alone have caused considerable damage to schools. For example, the 2008 hurricanes damaged approximately 1,000 schools and destroyed 120, while Hurricane Matthew in 2016 damaged 3,452 additional schools and destroyed another 521[8]. Including the 2010 earthquake, the three disasters combined have affected nearly 13,000 schools countrywide, representing about 70% of the 18,000 schools registered in Haiti (see Table 3). In contrast, during the same period, less than 750 public schools are estimated to have been rehabilitated or reconstructed[9].

The gap between the needs and the reconstruction pace shows the long-term consequences of each disaster on Haiti's learning and teaching conditions. Due to the lack of repairs, students and teachers often spend months and even years in tents or other temporary structures until their school is rebuilt, affecting student learning and achievement. In 2010, when the earthquake struck, many public schools affected by the 2008 hurricanes were still on MENFP's priority list for reconstruction.

6 Haiti. Earthquake's Post Disaster Need Assessment (PDNA) 2010: Evaluation des dommages, des pertes et des besoins généraux et sectoriels.

7 MENFP: Etat des lieux du secteur Education. Working documents of 26th February 2010

8 MEF. (2016 October). Evaluation rapide des dommages et des pertes occasionnés par l'ouragan Matthew et éléments de réflexion pour le relèvement et la reconstruction. Version préliminaire

9 Around 500 before the earthquake (THEUNYNCK, Serge. (2010). Aide-Mémoire de la mission de la Banque Mondiale relative aux questions de génie-civil. Note Technique. World Bank) and approx. 250 after the earthquake, according to the author's estimate (see Table 5).

School infrastructure needs

According to the 2013 school census[10], the Haitian Education sector totaled approximately 18,000 schools, including both public and private institutions, enrolling around 3,500,000 children. Among those schools, only 16% (2,710) are public, run by the Ministry of Education, while the great majority (84%) are run by the non-public sector (church networks, organizations, communities, or other private entities). The shortage of public schools and the fees charged by private establishments leave the most vulnerable population unable to access education. In 2018, it was estimated that between 400,000 and 500,000 school-age children were outside the education system, representing a gap of 10,000 classrooms (nearly 1,000 schools)[11]

The existing school infrastructure varies largely in quality. Of the 2,710 public schools, two-thirds are operating in official school buildings with regular classrooms. However, most of them exhibit signs of poor quality and maintenance (see Table 2). The remaining one-third operate in non-conventional spaces, such as shelters (22%) or in private premises, mainly houses or churches (16%). The new public schools constructed after the 2010 earthquake, following the new standards, represent approximately 10%[12] of the public sector (see Table 5). Regarding access to basic services and sanitation, the 2013 census found that among the 18,000 schools, only 50% of them had access to water, only 20% had toilets or latrines, and only 10% had access to electricity.

The vulnerability of the school infrastructure

Countrywide school infrastructure needs were already enormous in 2010 before the earthquake and continued to be a priority in 2020. Beside the reconstruction/rehabilitation of existing schools affected by disasters, there is also a need to create approximately 10,000 additional classrooms to reach 100% of primary school demand by 2030, as laid out in the Decanal Plan for Education 2020-2030[13]. The considerable international mobilization for school reconstruction after the earthquake by various organizations, including the IDB, has allowed the reconstruction of approximately 2,275 classrooms in the public sector, representing 20% of the expressed needs (see Table 5).

10 MENFP/DPCE. Annuaire statistique 2013-2014. Port-au-Prince. October 2015.

11 UNICEF rapport Enfants hors des écoles 2018.

12 IDB estimations

13 MENFP: Plan Décanal d'Education 2020-2030, December 2020.

All sectors	Schools	of which public	Students	of which public
Fundamental*WW	17,036	2,710 (16%)	2,889,550	688,869 (23%)
PreschoWols	10,838	815	617,785	43,725
Total	17,828**	2,716**	3,507,335	732,594

* Fundamental schools include all three cycles of basic education in Haiti, equivalent to Grade 1 through 9.]
** Total is not the sum since one school can have different levels

Table 1. Apportionment of schools and children (public and private). Source: MENFP 2013-2014 census.


New schools (10%*)


Old schools (52%)

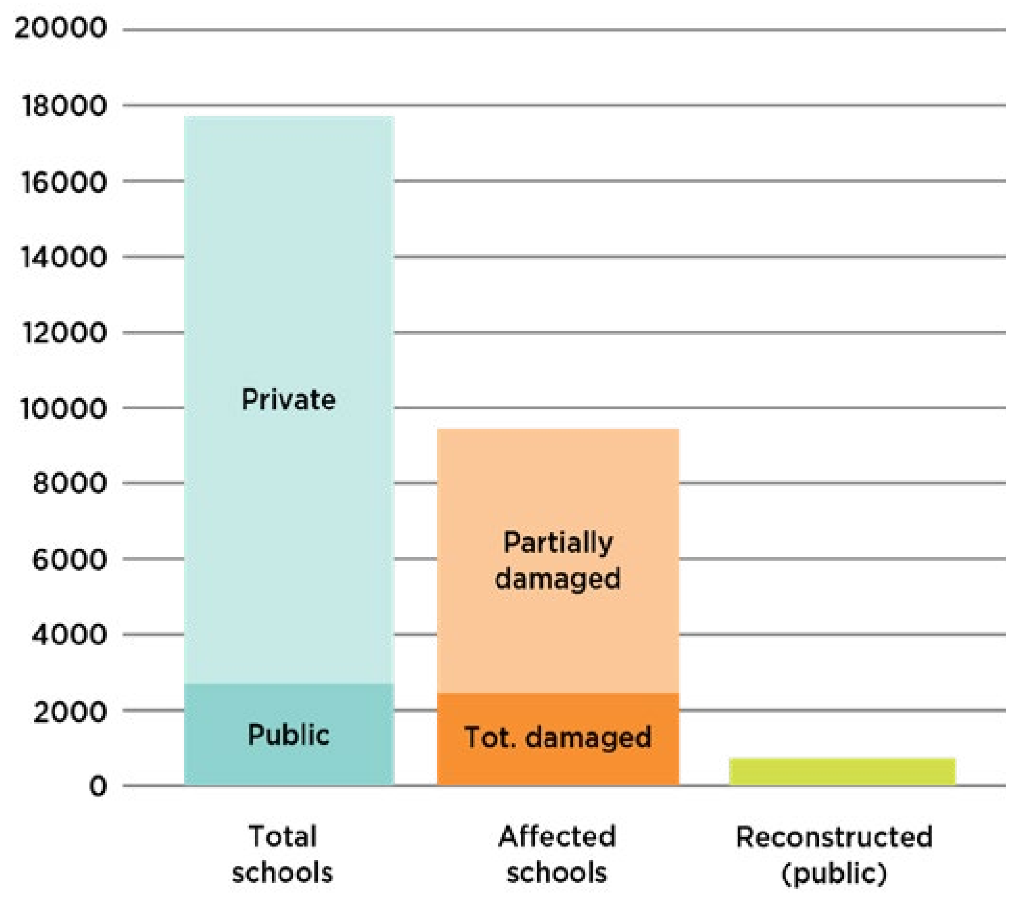

Shelter (22%)


Other (16%)

* Estimations IDB. Photos: C. Ubertini.

Table 2. Type of infrastructure for the public schools. Source: MENFP 2013-2014 census.

This high demand for school infrastructure throughout Haiti is reflected in the list of schools that the MENFP and the IDB agreed to reconstruct via the previous operations. Among the 90 schools reconstructed by the Program, less than 20 were directly affected by the earthquake and located in the two most affected departments. The great majority of schools that were rebuilt/built were on the MENFP's priority list prior to the 2010 earthquake.



Disasters	Damaged schools	Destroyed schools	Total affected schools	% of 17,828 schools
2008: Hurricanes	1,000	120	1,120	6%
2010: Earthquake	6,000	2,000	8,000	45%
2016: Hurricane Matthew	3,452	521	3,973	22%
Total*	**10,452**	**2,641**	**13,093**	**73%**

* The 14 August 2021 Earthquake in the southwest of Haiti, has affected 727 additional schools (171 destroyed and 556 damaged). Source: Centre d'opérations d'urgence national, Rapport d'étape no 1, Rapport de situation no11, 4 septembre 2021.

Table 3. Estimate of affected schools between 2008 and 2018. Sources: PDNA, World Bank, MENFP, and IDB. Photo and graphic by C. Ubertini.

The National school of Dessources after the 2010 Earthquake
Photo: Christian Ubertini (SDC)

The new National school of Furcy.
Photo: Alison Elias (IDB)

IDB's contribution 2010-2020

As an immediate response to the earthquake, the Bank modified an existing operation (HA-L1040 (US$20M) to support the MENFP in restoring activities in the education sector by May 2010 as outlined by the Government of Haiti. The available resources were used to support teacher salaries in the private sector (along with the World Bank), student and teacher kits (a basic set of learning and teaching materials), and the provision of temporary structures to allow the resumption of educational services by May. As a result of close collaboration between the MENFP, Ministry of Finance, and the IDB, 58 schools were successfully equipped with temporary structures by May 2010. Other donors provided tents and other semi-permanent structures to allow schools to resume services.

In addition, the IDB made an initial commitment to contribute US$250M over a 10-year period to the education sector and to engage in fundraising efforts to match the amount. The Program design, consisting of a series of investment grants, was based on the MENFP's 2010-2015 Operational Plan (OP) combining school infrastructure, following the new school construction standards outlined in the OP, and soft initiatives, aimed at improving the quality of education, which included school materials and kits, a tuition waiver program allowing children to enroll for free in select non-public schools (in coordination with the World Bank), teacher training, early childhood education, curriculum reform, education monitoring information system (EMIS), and modernizing the national assessment system. The programmatic support was provided through a series of four operations, some of which had matching funds through donations from other entities. The details for the infrastructure component that encompassed the four operations are listed in the section below.

Funding

Following the restructuring of the HA-L1040 to respond to the emergent needs following the earthquake, the IDB approved its first education operation after the disaster (HA-L1049, US$50M) in November 2010. Efforts to mobilize other donor financing generated an additional US$31M in co-financing, including Canadian funding for International Development (CAD20M), the Haiti Reconstruction Fund (HRF, US$10M), the First Citizen Bank of Trinidad and Tobago (US$1M), and the Chilean Cooperation providing an in-kind grant equivalent to US$89,800. In November 2011, the IDB approved the second education operation (HA-L1060, US$50M), signed on March 2012, with additional co-financing from the Government of Finland (US$6,48M); the Haiti Reconstruction Fund (US$ 3,7M); and the HAPPY HEART FUNDS (US$637,674). The third operation was approved in November 2012 (HA-L1077, US$50M). Finally, the fourth operation (HA-L1080) was approved in November 2014 (HA-L1080; US$24M).

			Total in US$			of which infrastructure* in US$		
Operation		Date	Total	IDB	Co-funding	Total	IDB	Co-funding
HA-L1049	ARSE	2010	81,000,000	51,000,000	31,000,000	48,596,000	30,623,000	17,973,000
HA-L1060	AMOPERE	2011	60,817,674	50,000,000	10,817,674	23,438,000	19,560,000	3,878,000
HA-L1077	ACEQH	2012	50,000,000	50,000,000	-	22,700,000	22,700,000	-
HA-L1080	APREH	2014	24,000,000	24,000,000	-	5,579,000	5,579,000	-
Total			215,817,674	175,000,000	41,817,674	100,313,000	78,462,000	21,851,000
			* Also includes construction and equipment of 4 TVET centers for US$9M					

Table 4. Funding per operations and repartition for the infrastructure component. Source IDB.

The new National school of Chansolme.
Photo: Alison Elias (IDB)

Achievements

The entire Program resulted in the rebuilding of 90 public schools and 1,024 classrooms, including 186 classrooms for early childhood education. This represents nearly half of the total number of classrooms constructed in the public sector for the 2010-2020 period, estimated at 2,275 classrooms (see Table 5).

The 90 schools reconstructed[14] by the Program have a total capacity of 40,000 seats, providing a safe and comfortable learning environment for approximately 60,000 students each school year (with 50% of the schools functioning in double or triple shifts). Out of these 40,000 seats, 17,000 are newly created seats, representing an increase of approximately 42% of the capacity of the schools.

14 As of December 2021, 8 schools are still finalizing construction.

Program's expansion beyond 2020

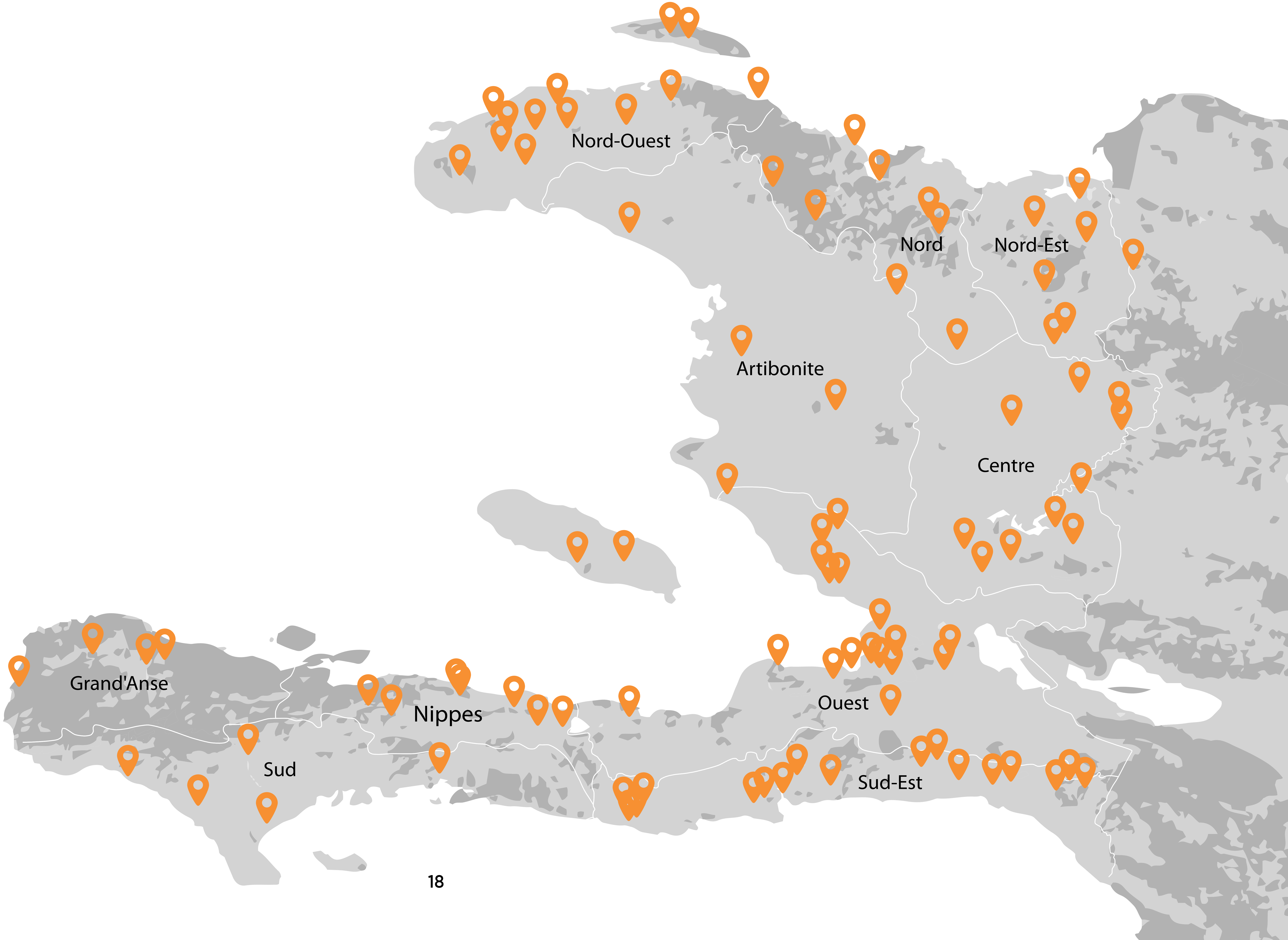
The IDB programmatic support to the Government of Haiti will continue in the next years. The last operation (50M) was approved by the Board of Directors in the 1st semester of 2021. Although it does not include any infrastructure work, it will further support (i) the governance of the education sector including school planning; (ii) access to education through tuition waivers; and (iii) quality education in public primary schools. The new operation, called Support to the Haiti Education Sector Plan (SHESP) is fully aligned with the MENFPs 2020 – 2030 Education sector plan which was approved in December 2020.

	Classrooms			Total	
	Preschool	Grades 1-6	Grades 7-9	Classrooms	Schools
IDB & co-funding					
MENFP / FAES	140	420	210	770	70
MENFP / UTE	46	138	69	253	20
Total IDB & co-funding	**186**	**558**	**279**	**1,023**	**90**
Other institutions*					
MENFP / PEQH (World Bank)	-	160	-	160	57
DIGICEL Foundation (public schools only)	37	221	64	322	40
UNICEF	32	96	48	176	16
Swiss Cooperation (SDC)	24	72	36	132	12
Spanish Red Cross	14	42	21	77	7
Others (estimated)	20	60	30	110	10
Total other institutions*	**127**	**651**	**199**	**977**	**142**
Since 2020					
MENFP / Fond National d'Education	50	150	75	275	25
Grand total	**363**	**1359**	**553**	**2,275**	**257**

Table 5. Estimated school construction in the public sector for the period 2010-2020.
***Source IDB survey of institutions in 2014.**

The National school of Degand.
Photo: Alison Elias (IDB)

School construction financed by the Program for the 2010-2020 period



The new National school of Délices in a slopy land (under construction).
Photo: Alison Elias (IDB)

The access road to the National school of Layaille during the rainy season.
Photo: Christian Ubertini (IDB)

The technical challenge

Developing planning tools

In 2015, the IDB conducted a comparative analysis of school infrastructure planning and management models in 12 different Latin America and Caribbean (LAC) countries to identify best practices and bottlenecks in these processes[15]. The study identified six planning components considered by the LAC countries as key tools to facilitate the management of school infrastructure (see Table 6). Even though Haiti was not included in the study, the key tools identified are relevant for Haiti as well.

15 Learning in Twenty-First Century Schools: Note 9.

KEY TOOLS	ARG	BRB	CHL	CRI	GTM	HON	JAM	PAN	PER	TTO	URY	HAITI* 2010	HAITI* 2020
1. National policy for school infrastructure with clear objectives	●		●	●	●	●	●	●	●		●		
2. Institutionalized strategy to identify and prioritize needs (school planning)	●			●	●	●		●					○
3. Georeferenced information on demographics and school infrastructure	○					●			○		●		●
4. Efficient processes for land identification and acquisition						○							
5. Specific regulations and standards for school infrastructure design	○	●	●	●	●	●	●	●	●	○	●	○	●
6. Prototypes and project designs [up to adequate standards]	○			●	●	●					●		●

● available ○ in progress or incomplete

Table 6. Availability of key tools for planning and management of school infrastructure in some LAC countries. Source: IDB. Learning in 21st century schools. 2015. *The data for Haiti have been added by the author.

The availability of these planning tools demonstrates the country's level of preparedness in case of (re)construction needs, as well as its experience in large-scale school infrastructure programs. The more tools a country has, the more experiences it may have acquired, and more prepared it should be in case of rapid and large school construction demand. In Haiti, among the six identified planning and management tools, only the one related to standards for school infrastructure design (point 5) was partially available in 2010, when the Program started. All the other tools were missing, thus reducing the capacity of the sector to respond effectively and in a timely manner to the reconstruction needs, indicating a possible gap of experience in managing similar large-scale construction projects.

Among the five missing tools, the ones related to identification needs, school planning (point 2) and demographic data (point 3), did not have an immediate impact for the Program since the needs were already well identified (reconstruction of public schools affected by the earthquake and other public schools that were in urgent need).

On the other end, the two unavailable tools related to the prototype design (point 6) and to the process for land identification / extension (point 4) were the ones mostly affecting the project implementation, as thoroughly detailed in the next chapter. The absence of pre-validated disaster-resilient prototypes and other planning tools prevented the Program to start with a solid implementation strategy, previously tested, and experimented in the local reality. This situation created various bottlenecks during implementation, which led the Program to strengthen the project preparation phases by adopting common tools, guidelines, and other reference documents (mainly school prototypes and construction documents) to solve existing weaknesses and anticipate further issues. At that time, these referential documents were under elaboration by the MENFP, which only made them available for the sector in April 2014 (see Table 9). The prototypes were then gradually integrated in the Program whenever possible. Nevertheless, out of the four operations, only the last one (HA-L1080), could benefit from these tools from the beginning of execution.

Building the confined-masonry model (MC).
Photo: Christian Ubertini (IDB)

The confined-masonry model for rural areas at the new National school of Lamarque (here with a light gauge steel roof structure).
Photo: Alison Elias (IDB)

The new National school of Ravine Trompette
Photo: Alison Elias (IDB)

Situation in 2020

Over the 10-year 2010–2020 period, the planning and management situation of school infrastructure in Haiti has improved significantly.

The tools related to the design (point 5 and point 6) are the most complete ones, thanks to the partnership agreement (2012) between the MENFP, the IDB, and the Swiss Agency for Development and Cooperation (SDC) providing its technical expertise to develop a full package of plans and guidelines to ease and accelerate the school construction processes[16]. This package includes full plans of different school prototypes, bill of quantities, validation procedures, supervision manuals and guidelines, etc. These tools became official standards in April 2014 and have since largely been used either by the Program, by the MENFP through the *Fond National d'Education* (FNE), or by other actors. These documents are accessible on the MENFP's website[17].

Since 2018, the IDB and the MENFP have also been working to elaborated micro-school planning for each municipality (point 2 and point 3), in the form of school cartography. These tools will provide clear information on the actual educational demand and supply in each community and allow for more fine-tuned interventions in the future. The first set of municipal school planning documents (financed by HA-L1077) are also available on the MENFP's website[18].

The two planning tools still missing today are the ones related to the site identification/ extension (point 4) and to the national policy for school infrastructure (point 1). For site identification, a workshop with the different stakeholders was organized by the IDB in 2012 but no progress was made thereafter. Land issues—limited supply of land that could be used for public projects—remain a major concern for the development of school infrastructure in Haiti[19].

Regarding the school construction national policy, the IDB has produced several working papers presenting some preliminary reflections towards a national policy to up-scale school construction in Haiti based on experiences and lessons learned. Part of these reflections are presented in Chapter 3.

16 From 2010 to 2016, the SDC has provided technical assistance to the MENFP to normalize school construction standards, mainly through school reconstruction and elaboration of earthquake- and hurricane-resistant school prototypes and other construction documents.

17 https://menfp.gouv.ht/#/documents/official

18 Today, the new EDU operation HA-L1102 and World Bank are financing the remaining cartographies.

19 « Actes de l'atelier identification des sites », Côtes-Des-Arcadins, MENFP, 14 et 15 février 2011.

Revising school norms

In 2010, most Haitian schools (public and private) were still functioning with a traditional six-classroom model for primary education (grades 1–6) despite a 1982 reform that aimed to turn the six-grade primary schools into nine-grade fundamental schools[20]. After the earthquake, the MENFP took the opportunity to revise its school norms and requested that all new basic education schools be constructed with nine classrooms, adding the three final grades (grades 7–9) to the original six primary school grades. In addition, the MENFP decided to equip all new public schools with a new section for early childhood education, adding two classrooms to the school program requirements. Therefore, since 2010, the standard Haitian school has 11 classrooms in total, nine fundamental and two preschools, commonly known as the "9+2" standard[21].

The school typology remained traditional, with a regular classroom measuring 50 square meters to accommodate 40 students (ratio of 1.25 m2/student) for the fundamental grades, and 40 m2 for the preschool for 25 students (ratio of 1.6 m2/student). In addition to the classrooms, more rooms (administration, library, computer room) and equipment (sanitary facilities, school canteen, deposit) necessary for the functioning of the school were added. The 9+2 school standard is set for 410 students in a single shift. Nevertheless, most of the schools in urban or peri-urban areas function in two or three shifts, often bringing the number of students up to 1,000 per school.

In terms of surfaces, the 9+2 school along with its annexes has a covered area of 1,445 square meters (including walls and circulations) and needs a land size of minimum 4,000 square meters to accommodate single level buildings with a central court with a playground and sufficient area to safely circulate around the site (see Table 7).

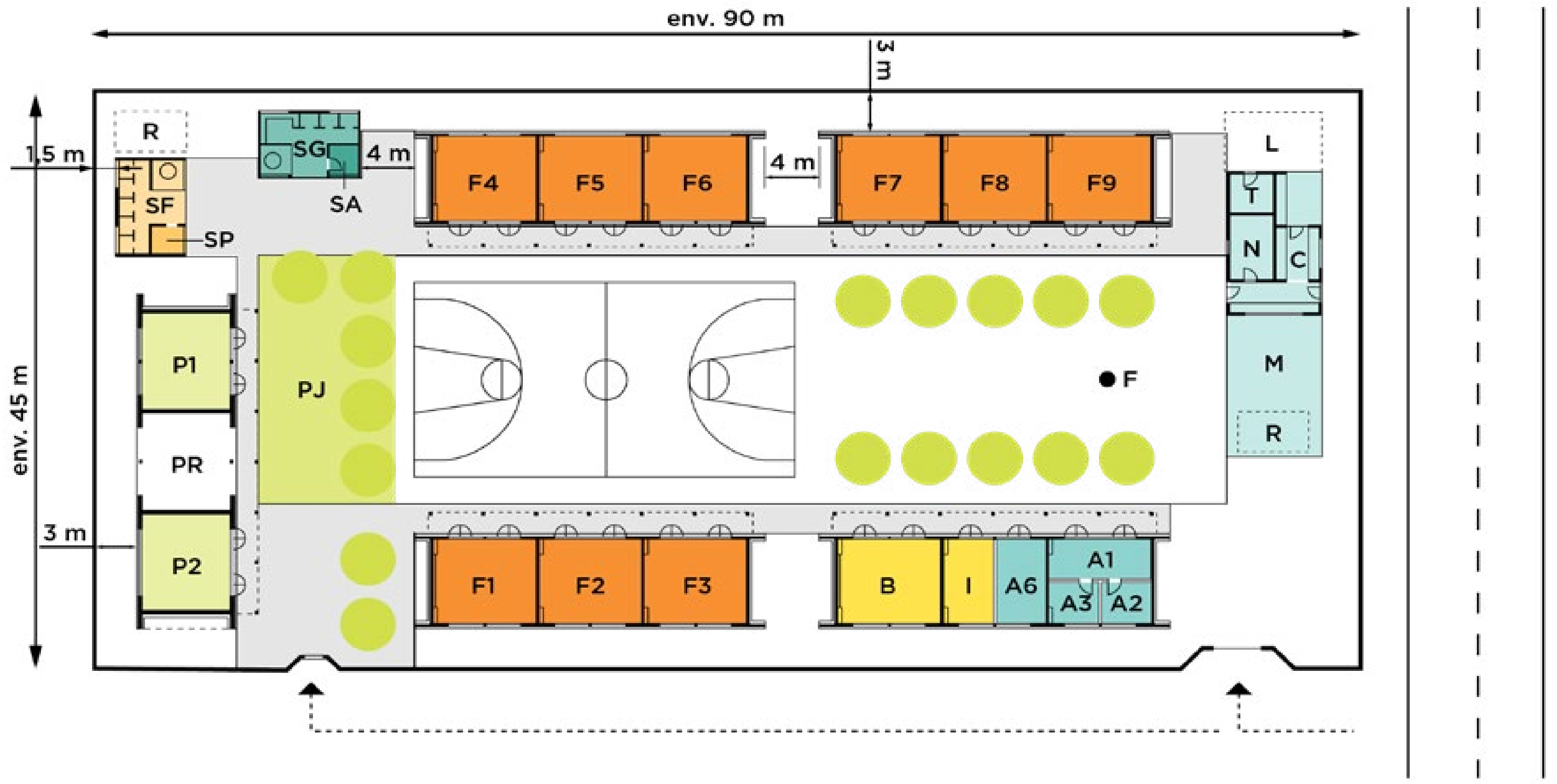
Disaster-resilient standards

The natural disasters that have affected Haiti since 2008 have highlighted the extreme vulnerability of the buildings and especially of school infrastructure (see Table 3). Expert reports[22] point out the poor construction quality, the obsolescence of building codes, and the deficiency of the construction regulation mechanisms. The vulnerability of school infrastructures is not only a Haitian

20 Ministry of Education (1997) « Plan National d'Education PANES ». Port-au-Prince.

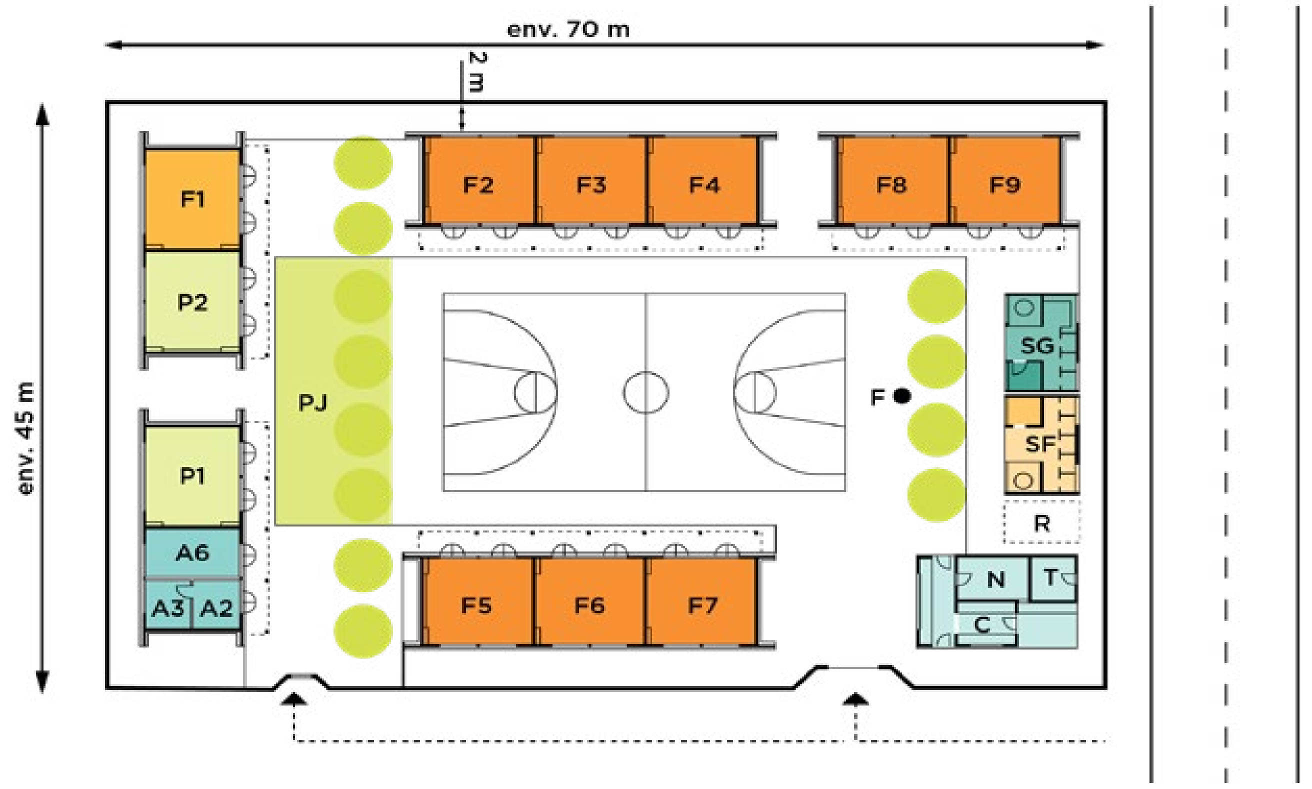
21 MENFP (2010). Normes de construction scolaire. MENFP. See also : Guide pratique, version Avril 2020. MENFP website.

22 PAULTRE, Patrick. (2010). Mission d'appui à la préparation d'un document stratégique sur le bâti scolaire. Note Technique. World Bank



Standard scenario
Land size: 4,000 m2 (45 x 90 m)
Constructed area: 1,455 m2
Capacity/seats: 410
Central courtyard: 1,400 m2 (3.4 m2/children)

Minimal scenario
Land size: 3,150 m2 (45 x 70 m)
Constructed area: 1,200 m2
Capacity/seats: 410
Central courtyard: 900 m2 (2.2 m2/children)



Codes	Functions	Floor area	Constructed area	%
P1-P2	Preschool (2 classrooms) + covered space	150 m2	245 m2	16 %
F1-F9	Elementary (9 classrooms)	450 m2	735 m2	50 %
B / I	Library / workshop space	75 m2	123 m2	5 %
A1-A4	Administration + teachers office	75 m2	122 m2	13 %
Other	Annexes (sanitation, kitchen, technical)	200 m2	220 m2	16 %
Total		950 m2	1,445 m2	100 %

Table 7. Examples of floor and constructed areas of a standard 9+2 schools built in Haiti under the IDB financed operations. Source: Guide pratique.

concern. Many other countries, especially in the Caribbean region, have recently faced similar threats. According to the 2020 OCHA report, "Natural disasters in Latin America and the Caribbean," between the years 2000 and 2019, a total of 330 storms affected the Caribbean region, including 148 tropical storms and 181 hurricanes (an average of 17 hurricanes per year) out of which 23 reached Category 5 status, affecting a total of 34 million people during that period.

The intensity and occurrence of natural disasters represent a new reality in the entire Caribbean and coastal regions. This will require specific attention in future IDB financed projects by probably investing more time in planning to find adequate resilient design.

In November 2020, with winds up to 185 mph (300 km/h), Hurricane Iota severely damaged and rendered inoperative two brand new schools financed by the IDB in Colombia. The case of these two schools, built according to the Colombian codes by qualified companies, posed a question on the current norms and design practices considering the great increase of intensity and recurrence of natural hazards in the region. In the last four years, six hurricanes classified as category 5, the maximum level on the Saffir-Simpson scale describing the intensity of storms, have affected the Caribbean region . The intensity and occurrence of these events represent a new reality not only in fragile states like Haiti, but in the entire Caribbean and coastal regions. This will require specific attention in future IDB-financed projects by investing more time in planning to find adequate disaster-resilient designs before launching construction activities.

The new reality of seismic-resistant standards

In Haiti, the 2010 earthquake forced the GoH to temporarily suspend all construction permits, to allow the revision and adoption of a new Code of Construction (CNBH 2012) with adapted norms for seismic and hurricane resistance.

In February 2011, the Ministry of Public Works (MTPTC) set the new calculation rules for structural design requiring that all new public buildings resist seismic hazards based on a 2% of probability in 50 years, which means to withstand a natural disaster that can occur every 2,500 years[23]. The MTPTC recommended considering wind speeds up to 130 mph depending on the area, which corresponds to a category 4 hurricane

23 These values are consistent with the recommendations of the International Building Code IBC 2009. See: MTPTC. (2012). CNBH Haiti.

Building the reinforced concrete model (BA).
Photo: Christian Ubertini (IDB)

The concrete multistorey model for urban areas at the new National schoolof Argentine Bellegarde.Photo: Christian Ubertini (IDB)

on the Saffir-Simpson scale. This level of safety standards implies new structural dimensioning, significantly higher than previous standards and design practices in Haiti.

Changing construction design and practices requires time, trained professionals (engineers and workers), and a well-functioning quality control mechanism by a legal/technical authority to ensure that calculation, plans, and works are executed in conformity with the new norms.

The Program experienced difficulties adapting to new standards with the first group of 19 schools launched in 2011. The 19 schools were awarded to 19 different local contractors, through a turn-key contract giving the construction firms the entire responsibility of the design and construction. These school designs were still based on previous norms and practices with usual structural systems, weak dimensioning, and poor execution quality. In 2012, an external structural evaluation, carried out while these 19 schools were under construction, highlighted design weaknesses leading to the temporary suspension of work and to the implementation of corrective measures[24]. Eventually, contractors have also preferred to abandon ad hoc designs and replace them by the official prototypes of the MENFP.

24 FORSTMANN, Philippe et al. (2015 Dec.). Mid-term review HA-L1049. MENFP/IDB. p.24.

Designing prototypes adapted to the context

Designing a cost-efficient resilient infrastructure that addresses multiple natural hazards (earthquake, hurricane, floods, draught), while ensuring basic architectural requirements (comfort, natural light, ventilation) and sustainability criteria (climate responsive design, low maintenance, replicability), is a complex challenge in a country such as Haiti, with its fragile socio-economic reality and weak infrastructure networks (poverty, limited access to water and electricity, precarious roads and difficult access to remote places, scarce availability of construction materials, and limited skills). All these factors reduce the capacity of the local construction market and limit the range of possibilities for cost-efficient, resistant, and comfortable design solutions.

The prototypes do not aim to propose the most innovative and attractive architecture, but rather the best adapted to the constraints: material and skills availability, budget, low maintenance, durability, and replicability.

The design challenge becomes even more complex, considering that design principles recommended to withstand different types of risks can vary and even be inconsistent with each other. For instance, if light-weight structures are recommended for a better seismic resistance, heavy structures and well-anchored roofs are more efficient to withstand hurricanes. Likewise, design solutions addressing climatic concerns, such as large roofs and eaves protecting the façades from the rain and the sun in a hot and humid climate, are not durable solutions for places where high-force winds can tear off roofs. Finally, the territorial context of Haiti, mixing high density urban areas, and hard-to-access rural areas, requires different answers in terms of design and implementation means.

To address these different constraints, three prototypes have been developed to the specific contexts of the territory (urban, rural, and remote areas) proposing technical solutions suitable to the local construction market. The prototypes did not aim to propose the most innovative and attractive architecture, but rather the best adapted to the constraints—material and skills availability, budget, low maintenance, durability, and replicability.

A concrete multi-store model for urban area (BA) and for large construction firms

This model, developed in several typologies of 6 to 9 classrooms on 2 and 3 levels, has been specially designed for urban areas where the exiguity of the land requires multi-story buildings. The light, ductile reinforced concrete structure has been especially designed to withstand hurricanes and earthquakes despite its light dimensioning. The structure is made of a repetition of shear-walls that are placed in both directions. The large openings in between the shear-walls are filled by light materials, grids in the façade, and wooden storage shelves between the classrooms. The classrooms are well ventilated, ensuring a constant flow of air and a reasonable temperature inside. The large eaves on the facades keep the spaces shaded and protected against the rain. Doors and windows have been replaced by open grids to ensure both sufficient natural light and ventilation, but also to protect against vandalism. These elements have been designed to require little to no maintenance. They are painted with one color per classroom animating the façade and balancing the greyish color of the concrete. This model requires a good execution and supervision skills and cannot be implemented at community level.

A “confined-masonry” model for all areas (MC) and for small and medium enterprises (SMEs)

This model, developed in 2 typologies of 2 or 3 classrooms on single level, has been developed for school buildings located in all areas. The “confined masonry” structure is an improved version of the traditional cement masonry construction technique widely used in Haiti. The building is covered with a light roof, built either in wood or in metal. Windows and doors are similar with the urban model, ensuring same level of comfort. This model is more accessible financially and is also technically more adapted to small and medium construction enterprises (SMCEs), that constitutes a major part of the Haitian construction sector, and it can also be implemented at the community level.

A vernacular model for remote areas (OB) and for micro-enterprises at community level

This model, developed in 2 typologies of 1 or 2 classrooms on single level, was designed for remote and difficult-to-access areas. It brings technical improvements to locally existing vernacular constructions and emphasizes the use of locally available materials and labor skills. The construction system is made of a wooden structure filled with small stones or adobe bricks sealed with earth mortar. The system has been reinforced by metal elements (rods and anchor) to comply with the same earthquake and hurricane resistant requirement as the two other models. This model is a response to meet the schooling needs in remote areas. It can be implemented by micro-enterprises at the community level.

Table 8. three building prototypes adapted to the different territorial contexts. Photos: C. Ubertini and SDC (vernacular model).

An inter-institutional process

It took nearly two years (2012 and 2013) to complete the process of developing the prototypes and other supporting documents[25]. The design process was done through a working group, under the leadership of the MENFP and composed of the main actors involved in the school reconstruction[26]. The technical inputs and production of documents were undertaken by a technical team composed of local and international architects and engineers, following the consulting committee's input.

The 2014 decree

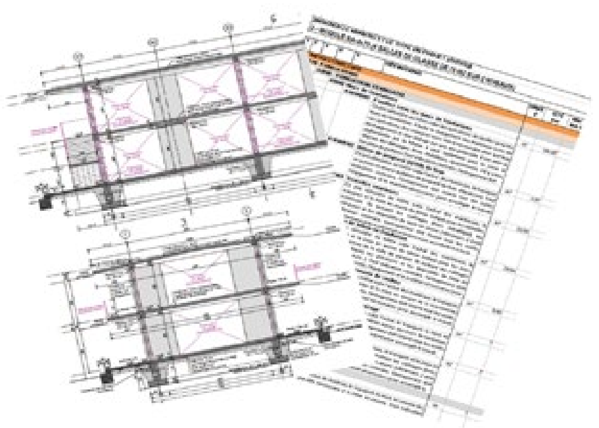
On April 1, 2014, the MENFP issued a decree establishing the new technical standards for school construction with a full package of supporting documents to facilitate and accelerate the pace of the school construction in the country. The following documents were developed and are accessible on the MENFP website (see Table 9).

- Full set of construction plans for three different predesigned school building prototypes, adapted to the different contexts of the territory (urban, rural, and remote)
- Indicative bills of quantity and technical specification
- Project description sheet to be validated by the MENFP
- Supervision tools and different manuals for building and maintenance
- Practical guide for planning and execution of school infrastructure

25 This is mainly due to the number of prototypes developed (6). The coordination process involving many different actors, and the validation procedure by the two ministries MENFP and MTPTC, following a special task force put in place before the validation.

26 Mainly: MENFP, MTPTC, Executing Unit (FAES), IDB, Swiss Cooperation, UNICEF, Spanish Cooperation.

Haiti school norms, guidelines, and prototypes



Prototypes
Full set of construction drawings for 3 different school construction models, modular, and adapted to the specific contexts of the territory (urban, rural, and remote), with bill of quantities and technical specifications.

Project validation sheet
The project validation sheet presents the project data and the master plan, for verification and validation by the authorities (and by the Bank before NO) before launching the final project studies.

Various manuals
These manuals provide construction firms and supervisors with illustrated examples and explanations of the various stages of the work. Manuals have been created for construction, supervision, and maintenance phases.

Practical guidelines
The practical guide is a guideline for the planning, design, execution, and supervision of school infrastructure in conformity with the new norms and standards. In its latest version, dated 2020, the guide a chapter on recommendations, based on lessons learned from the 10-year school construction efforts in Haiti.

Table 9. Main reference tools and documents elaborated for school infrastructure in Haiti, officialized through the April 2014 decree by the MENFP.

Cost aspects

The total budget of the infrastructure component of the four operations amounted to approximately US$100M, out of which approximately US$91M was allocated for the school construction and approximately US$9M for the construction and equipment of four TVET centers (see Table 4).

Average project costs per classroom and per student

For the 90 schools financed by the Program, the total project cost corresponds roughly to US$1M per school. This includes all costs related to planning, implementation, and supervision of works, including IDB expertise for project documentation review. Considering the nearly 40,000 seats created and the approximately 60,000 students who are benefitting from the infrastructure (50% of the seats in double shift), the average costs per seat created and per student are, respectively, US$2,275 and US$1,516 (see Table 10).

Average cost allocation per school and per activity

The following table presents the cost allocation per school for different activities. The changes of delivery methods during implementation, the devaluation of the Haitian currency, and the volatile political situation in Haiti, have resulted in cost variations from one project to another, which makes it difficult to come up with uniform costs. Nevertheless, we can present average costs using the Design-Build delivery method with prototypes and for lots of 10 schools[27].

27 See Table 7 for school's sizes.

Total project costs for school infrastructure (including preparation, design and supervision, construction, furniture, and equipment)	US$	91,000,000
Average project cost per school (90 schools)	US$	1,000,000
Average project cost per classrooms (1,023 classrooms)	US$	88,954
Average project cost per seat created (40,000 seats)	US$	2,275
Average project cost per student (60,000 with 50% double shift)	US$	1,516
Approximative yearly cost per student over building's lifetime (30 years)	US$	50

Table 10. Average project costs per classrooms and students

Phases and activities	US$	US$	%
Preliminary studies (lots of 10 sites)		**23,000**	**2 %**
- Environmental and Social Analysis (ESA)	3,000		
- Preliminary master plan (feasibility study)	5,000		
- Topographic survey	5,000		
- Geotechnical survey	10,000		
Execution (lots of 10 school DC + S)*		**880,000**	**82 %**
- Project design / adaptation of prototypes (3%)	25,000		
- Construction (100%)	800,000		
- Supervision of works (6%)	55,000		
Equipment (lots of 10 schools)		**120,000**	**12 %**
- School furniture	60,000		
- Electricity (solar panels)	25,000		
- Other equipment, kitchen, playground	35,000		
Others		**42,000**	**4 %**
- Environmental and Social Mitigation Plans	20,000		
- Elaboration of maintenance plans and trainings	10,000		
- Quality control from the MENFP	2,000		
- Technical support for project documentation review	10,000		
Total		**1,065,000**	**100 %**

* Design and Construction, with separate Supervision contract. See Project delivery methods for more details.

Table 11. Cost structure using the Design Build delivery method with prototypes and for lots of 10 schools.

Average construction costs/m2

The average construction cost per square meter (US$/m2) provides an indication of the standard of the construction, in terms of comfort and finalization. For the schools, standards are basic and minimal, including walls, roofing, doors, open windows (without glass), electrical wiring, painting, as well as incorporated wooden shelves and blackboard. This basic standard does not include air conditioning. The cost/m2 is calculated dividing the construction costs of a single building as per bill of quantity (e.g., the three-classroom MC prototype), by the constructed floor area (including walls, circulation, and covered spaces). This cost/m2 does not include the complementary infrastructures (annexes, landscaping, etc.) nor the design and supervision costs.

The average construction costs/m2 registered for the 2014-2017[28] period are between US$535 and US$622, depending on the models (see Table 12).

28 Basis: IDB financed programs (ARSE, AMOPERE, ACEQH, APREH) and Swiss Cooperation program (PARIS)

	MC prototype 	BA prototype 	BA prototype 	Prefabricated 
Material	Confined masonry	Concrete	Concrete	Light-gauge steel
Nb of level	1	2	3	1
Nb of classrooms	3	6	9	3
M2 of floors	175 m2	463 m2	700 m2	196 m2
Finishing	Basic	Basic	Basic	Basic
Average costs:				
Cost / building	US$ 95,000	US$ 250'000	US$ 375,000	US$ 121,912
Cost / classroom	US$ 31,600	US$ 41,600	US$ 41,600	US$ 40,637
Cost / m2	US$ 542	US$ 540	US$ 535	US$ 622

Table 12. Average construction costs in US$ of the different models for the 2014-2017 period. Note: the average costs are extracted from the firm's initial bids for the building only. Therefore, the cost/m2 for one building can vary from the cost/m2 for the entire project as reported in Project data sheets in Annex.

Photo: Christian Ubertini (IDB)

DISCLAIMER:

The following chapter refers to the experience of school construction in Haiti specifically. Learnings may differ from experiences in other contexts.

2. Learnings

The new National school of Furcy.
Photo: Alison Elias (IDB)

Photo: Christian Ubertini (IDB)

Choosing the right strategy from the beginning

Project delivery methods

The delivery of a construction project is divided into three main phases: Design (D); Construction (C); and Supervision (S). There are normally three different procurement methods used for achieving the construction project: Design and Supervision + Construction (DS + C); Design and Construction + Supervision (DC + S); or separated Design + Construction + Supervision (D + C + S). The most important difference between these three modalities is whether design is done and validated before (DS + C and D + C + S) or after the procurement process to hire a construction firm (DC + S). This also means whether the IDB will be able to review the final project design through an official request for Non-Objection (DS + C and D + C + S) or not (DC + S), as illustrated in Table 15.

The design phase is key for obtaining a good construction project[29].

If the design phase is hired as a consultancy (DS + C and D + C + S), the Expression of Interest (EOI) is compulsory and a key phase for shortlisting adequate design firms. The EOI should synthetically describe the project and provide links to the design brief or another document that describes the project's characteristics and expectations. Describing the client expectations and the project characteristics attracts a wider range of firms to obtain a better match with the scope and specifics of the project.

The shortlist of firms should be based on experience and capacity, and on an evaluation of a portfolio of similar projects. Analyzing portfolios guarantees that shortlisted consultants/firms have the adequate experience and competence for the project.

The project portfolio presents the consultant's and/or firm's built projects and includes pictures and technical data to allow the client to see at a glance the orientation, expertise, and added value of the consultant/firm for a specific project.

If the design is hired within the Design-Build contract (DC + S), the analysis of the portfolio of projects can be included in the evaluation of the technical proposal, within the standard Request for Bids (RFB).

The following sections analyze pros and cons of each delivery method's strategies, considering Haiti specifically.

29 Design Well, Build Better: A Guide for Planning, Creating, Overseeing, and Making Decisions about Social Infrastructure Designs provides detailed information on this topic.

Design and Supervision + Construction (DS + C)

Under normal circumstances, the "Design and Supervision + Construction" is the recommended practice for planning construction work. The design phase and the construction are separated into two different contracts. The design contract also includes the supervision, so the design firm bears the entire responsibility for the design and ensures that plans are correctly implemented on-site. This method centers attention on the design aspect and is best suited for projects aiming to achieve a specific architectural quality or which require a specific architectural response with regards to functionality, site integration, user-friendly aspects, innovation, bioclimatic design, etc.

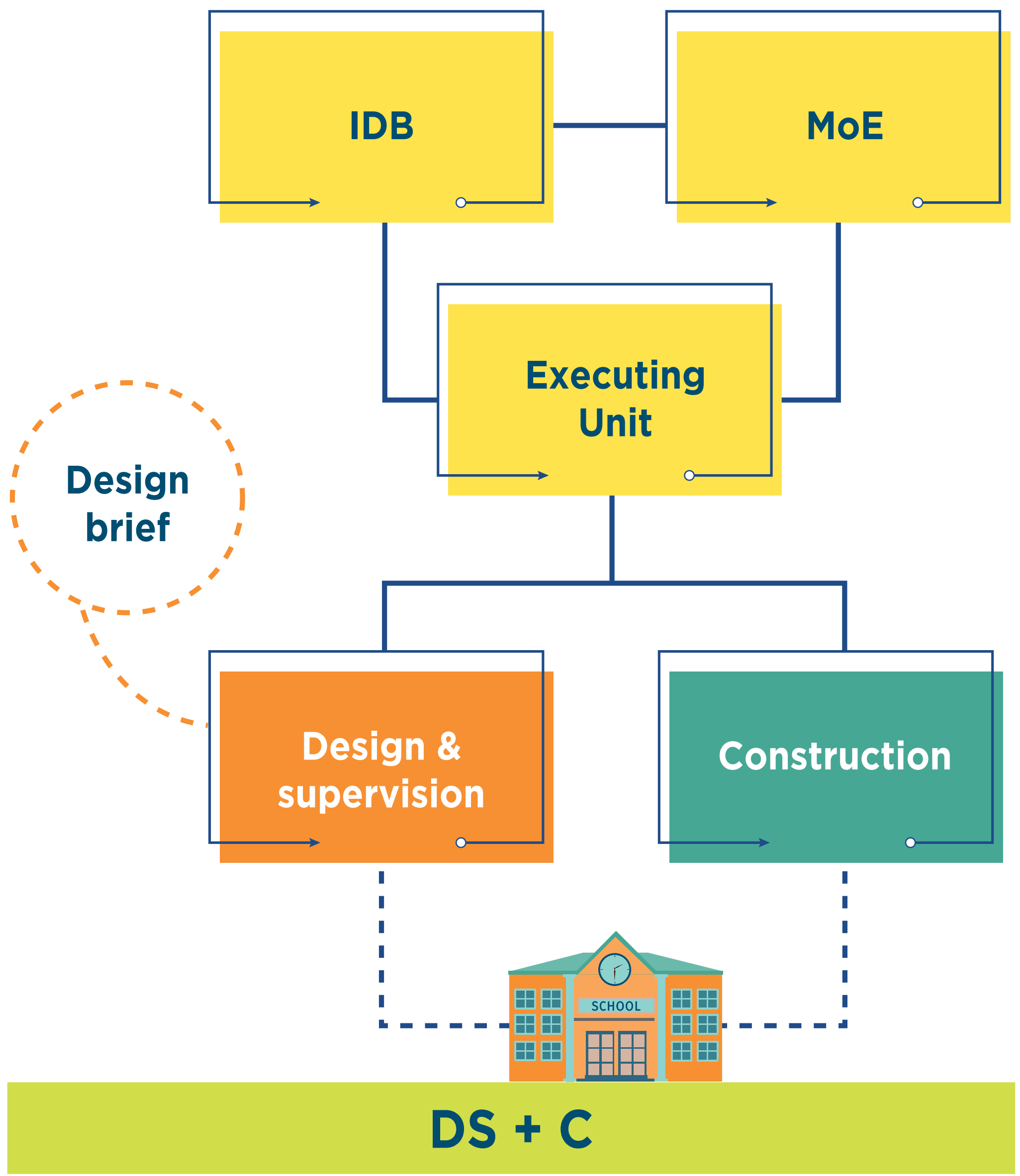


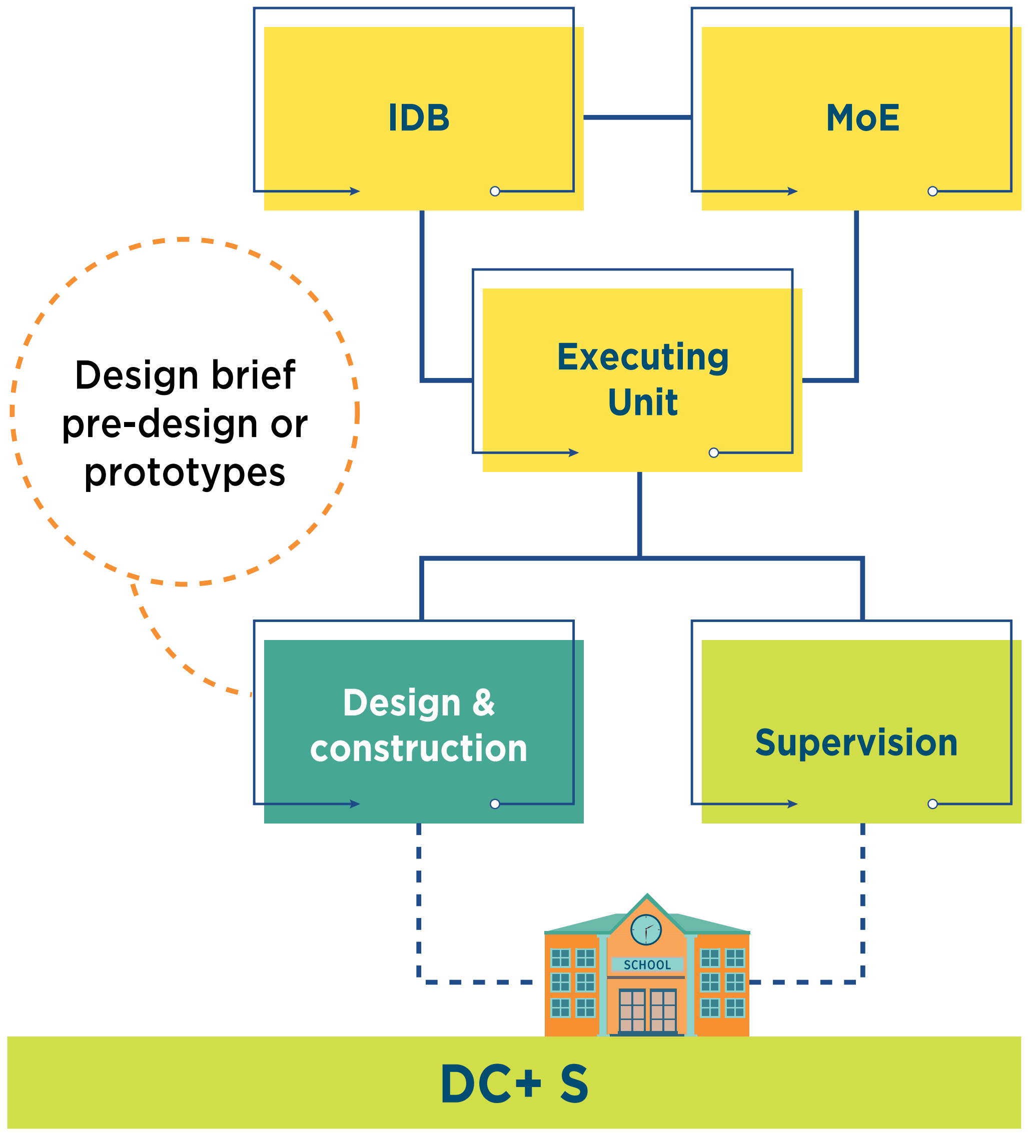
Table 13a. The main modalities to design, execute and supervise construction works. Illustration: C. Ubertini.

The advantages of this method are mainly for clients, who will be able to visualize and validate the design before contracting a construction firm; have the flexibility to adapt the project; and will have a more precise idea of the project costs before launching the bidding process. This method allows the IDB to see, review, and officially comment the final design through the Non-Objection procedure[30].

The Design and Supervision delivery method is adapted for single project or for a limited number of projects to be undertaken in parallel.

Design and Construction + Supervision (DC + S)

The "Design and Construction + Supervision" delivery method, also known as "Design-Build," seeks to accelerate the process by integrating the design phase into the construction firm contract. As such, the contractor becomes responsible for the entire realization of the project, playing both the role of the designer and the builder. This method has the advantage of transferring the risks to one entity—the contractor. Under this method the client has a limited ability to modify details of the design post-contracting. Additionally, while in a construction-only tender, the IDB would provide the non-objection to the bidding document, which includes a final design with detailed technical specifications, with a Design-Build. The IDB would give non-objection only to the technical specifications that inform the final design, included in the bidding documents, without being able to suggest improvements or modifications.



Efficiency of the "Design and Build" delivery method can be significantly improved with predesigns, prototypes or pre-validated master plans.

The technical solutions proposed by the contractor are mostly driven by the offered cost, and they usually follow standard market solutions, or specific construction methods preferred by the firm (such as prefabricated solutions and material). In Haiti, this method would be more adapted for projects that do not require specific architectural expertise, and for which well-known predesigned solutions are considered sufficient.

This method implies fewer contracts than other delivery methods and therefore it is supposedly less demanding for the EU in terms of contract management. However, there are several factors to consider when using the "Design-Build" method, mainly related to the level of technical preparation necessary prior to launch the tender procedure (design brief, prototypes, preliminary masterplans, etc.).

30 If the design is financed through an IDB loan

In the specific case of the Program, the considerations can be summarized as follows:

1. The importance of architectural design criteria and requirements were underestimated. For the first two groups of schools, the firms faced difficulties in proposing satisfactory designs, in terms of construction standards, and site layout for a child-friendly environment. As a result, the time to elaborate appropriate design documents took much longer than expected. Almost half of the proposed designs had to be redesigned to conform to the official prototypes of the MENFP once these were made available in April 2014.

2. The initial offers made without preliminary designs were often inconsistent with the actual work to be done on-site. This resulted in long negotiations with the EU to adapt the project to the budget, creating timeline extensions and cost increases.

3. When combined with a large-batch approach, this method proved to be approximately 20% more expensive (see Table 14) than for a small-batch approach (see "Small batch versus large batch" chapter).

4. When an ad hoc design is required to address architectural concerns, procurement documents for a "DC + S" process are usually more complex to elaborate than for regular consultancies.

The weak technical preparation led to severe bottlenecks during the implementation phase affecting both costs and timeline. In the end, the idea of saving time and costs through launching fewer procurement processes led to the opposite result (see Table 14).

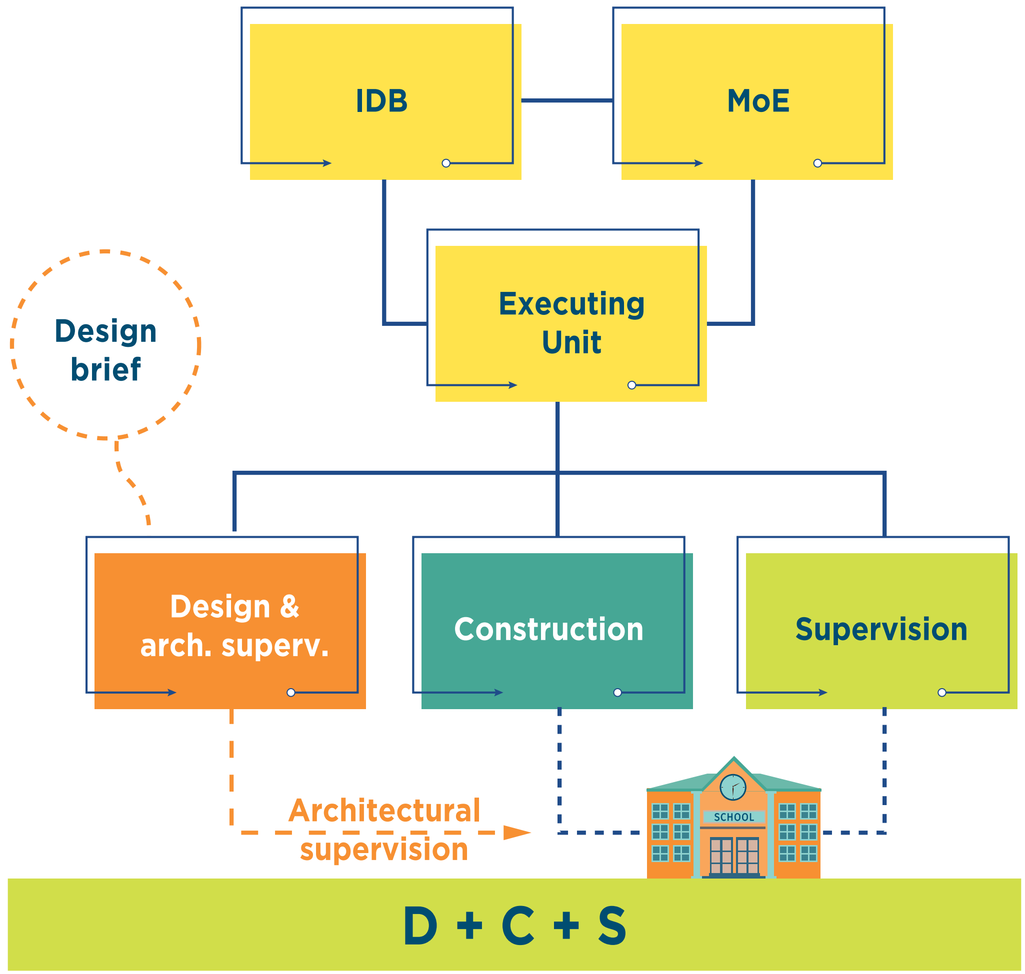
However, the "Design and Construction + Supervision" delivery method is widely used, especially for multiple projects in general. For a successful result, it is recommended to strengthen the planning and preparation phases by elaborating pre-validated documents for each site (pre-design, prototypes, master plans, detailed description of design requirements, etc.), which will minimize the risks of inconsistent offers and inadequate designs (see Table 15). These pre-validated documents were introduced to the Program in 2014, allowing the acceleration of the design phase and ensuring that basic standards (structural and architectural) are adequately addressed.

Design + Construction + Supervision (D + C + S)

In this delivery method, the three main activities are separated in three different contracts. This method gives the same priority to the design as the Design and Supervision method (DS + C), but it is better adapted for complex or large-size projects (e.g., hospitals, high technology buildings or multiple-projects, etc.) where the capacity of the design firm might not be sufficient to supervise a large or complex construction site.

When using this method, it is important to ensure that the design firm is present throughout the entire construction process ensuring the architectural supervision[31] of the project as described in the Supervision chapter. Architectural supervision is not mandatory but recommended to ensure architectural quality until the end of the construction even if a specialized firm is in charge of supervising the work.

31 Architectural supervision is a quality control of the design aspects during construction activities.



The new National school of Zabot.
Photo: Alison Elias (IDB)

Small batch versus large batch

The efficiency of the project delivery methods also depends on the number of schools awarded to the same contractor and its capacity to run several projects simultaneously. If large batches create economies of scale, small batches are easier to manage, at least in Haiti. The Program used both small and large batch approaches, which show clear differences in terms of costs and delivery time.

Small-batch approach

For the first 19 schools (ARSE 19), the Execution Unit chose a one-school-per-firm approach, combined with the Design-Build delivery method, but without pre-validated master plans or prototypes, as these were not available at the time. The absence of pre-validated prototypes and the weak design capacities of the firms caused unexpected delays, negatively affecting the completion of these 19 schools. Based on this experience, the approach was reconsidered and modified for the next group of schools as described below.

Despite these shortcomings, the small-batch approach was well adapted to the variety of situations, as the territorial dispersion of the schools did not allow for any economies of scale. It was also well adapted to the local construction market, as most local firms could compete in the bidding. As a result, the cost per school for these 19 schools was the most competitive in the Program (see Table 14). In the final analysis, the main weakness was the absence of planning tools (pre-validated master plans, prototypes), and not the one-school-per-firm strategy.

After experiencing large-batch strategy in the second and third operations (see Table 14), the last group of five schools (APREH) used the small-batch approach, with the advantage of having validated prototypes and pre-validated master plans. The combination of small batches and prototypes proved to be the most effective in terms of implementation time and costs.

Large-batch approach

The Program changed its strategy for the second and third operations by opting for large batches of 10 schools per firm. This was also an attempt to accelerate the Program's implementation by reducing the number of contracts and the time and effort dedicated to procurement procedures. This decision was also based on the conviction that larger batches would allow for economies of scale, and therefore would result in lower costs. As explained below, the experience proved the opposite to be true.

The combination of a Design-Build method with large batches was around 20% more expensive than the same Design-Build method but with single school batches.

The combination of a Design-Build method with large batches, such as for the second group of school (ARSE II), was around 20% more expensive than the same Design-Build method used by the first group of 19 schools (ARSE I) using the small-batch approach (see Table 14), for the following reasons:

1. The dispersion and remoteness of the sites do not allow any economies of scale.
2. Only a few companies in Haiti have the technical and financial capacity to bid for such large-size contracts and manage 10 constructions simultaneously, thus reducing competitiveness in the bids and increasing prices.
3. With large batches, the firms do not have the time to develop precise technical proposals for each site before the bidding. Therefore, they tend to increase the unit costs per school to cover any unexpected work arising at each specific site.

In terms of construction time, this approach did not prove to be faster than the single batch approach. Part of the delay originated during the design phase, while delays during construction phase were mainly caused by the logistical challenge of managing 10 remote sites simultaneously (mobilization of workforces, transport of materials, roads and other access issues, etc.). Finally, the firms had to momentarily interrupt work on some sites to concentrate on two or three at the same time.

The laudable intention to save time and money by reducing the number of procurement processes ultimately resulted in greater costs and delays[32]. Between the one-school-per-firm strategy used for the first group of schools and the strategy used for the 70 other schools (10 schools per batch), an intermediate solution (two, three or four schools per batch, and only one batch per firm), adapted to the size and financial capacity of the firms, most likely would have been more efficient and more cost effective.

32 This situation was particularly problematic in the third operation (HA-L1077), as the two initially selected contractors, each awarded a group of 10 schools, could not deliver. After long negotiations, their contracts had to be reduced by half, and a new process had to be launched to select other firms to take over the remaining schools.

Project reference	ARSE I	ARSE II	AMOPERE	ACEQH	APREH
EU	FAES	FAES	FAES	UTE	UTE
Date of contracts	2011	2013	2015	2015	2017
Type of contracts	DC + S	DC + S	DC + S	DC + S	D+C+S
With prototypes	No	No	Yes	Yes	Yes
Prototype models	-	-	MC model	MC Model	BA Model
Nb of schools	19	20 (+7*)	22 (+2*)	19	3**
Nb of classrooms	206	221	224	209	55
Nb of schools per lot	1	10	4 and 9	10	1
Nb of firms awarded	19	2	2	2	3
Design cost / school	-	-	-	-	30,000
Construction cost / school	750,087	948,878	675,316	760,985	1,474,902
Supervision cost / school	44,126	54,067	52,481	83,838	(88,494)
Total cost / school	794,213	1,002,944	727,797	844,822	1,563,396
Total cost / classrooms	**73,253**	**90,764**	**71,480**	**76,802**	**86,931**
Total cost / seat created	**1,831**	**2,269**	**1,787**	**1,920**	**2,173**

* School not included in the cost comparison presented in this table for consistency reasons.
** Out of which, two double-schools of 22 classrooms with multi-level urban prototype BA.

Table 14. Cost comparison between the different delivery methods. Source: FAES (monitoring table) and IDB.

Choosing the right project delivery method

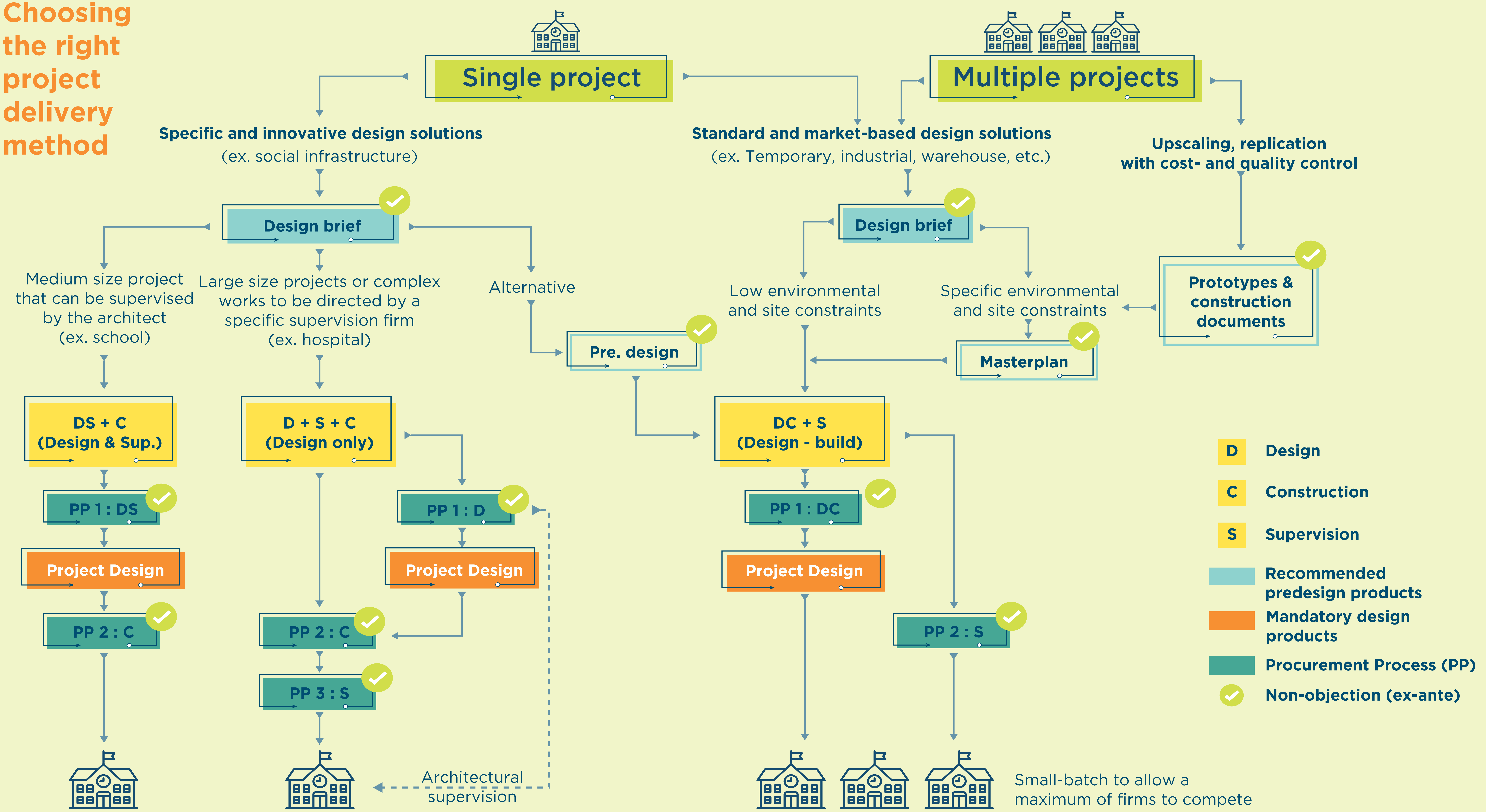


Table 15. Recommended process for each project delivery method. Illustration: C. Ubertini.

Supervision of works

The supervision of work during the construction phase is an indispensable activity that is usually done through external mandates either by the design firm (DS + C), or via a separate supervision firm (DC + S, D + C + S).

Supervision by the Design Firm (DS + C)

The supervision of work by the design firm is a recommended practice for mid-size construction projects such as schools. It reduces the number of intermediaries and strengthens the ownership of the project, and therefore, its quality. It also ensures that any design issues occurring during construction will be modified by the initial designer and not by someone else, guarantying design integrity from an architectural perspective.

The supervision of work by the design firm also allows the EU to benefit from the technical support of the design firm throughout the different phases of the project execution, including the procurement phase to select the construction firm (e.g., review of documents, technical propositions, especially timeline and methodology, etc.), until the end of the period of guarantee in a sort of "all-inclusive supervision services."

The consultation services for a "Design and Supervision" contract are usually split in three phases with the following main products:

Phase 1: Project design (approximately 4-5 % of construction costs):

- Concept and preliminary project design
- Final project design
- Bill of Quantities and technical specification for the tender

Phase 2: Supervision of works (approximately 6-7 % of construction costs):

- Support to EU for technical review of bids
- Verifications before the start of the construction (timeline, methodology, validation of shop drawings by the firm, administrative documentation, etc.)
- Direction of work and quality control
- Preliminary and final reception of work

Phase 3: Closure (approximately 1-2 % of construction costs):

- Supervision during the period of guarantee
- Approval of the as-build drawings
- Final report

External and separate supervision (DC + S and D + C + S)

Separating the supervision from the design allows the selection of a supervisory firm specialized in this type of service for complex or large-size projects, where the supervisory capacity of the design firm may not be sufficient. However, separating the supervision from the design poses several risks.

The first risk is the loss of technical leadership that the design firm had at the beginning of the project. In Haiti, it was noticed that when the design firm is out of the loop, projects tend to become delayed due to the non-decision-making from the parties (i.e., EU, construction firm, supervisor) during the execution phase. This also results in a loss of incentive for both the construction and the supervisory firms to complete the project on schedule.

The second risk is that design changes could be required during the site construction to address unexpected technical issues, to find alternative solutions for specific problems, or to correct errors. In the absence of the design firm during the construction phase, these design changes are developed by the construction firm (then validated by the supervision, and then approved by the EU) with the risk of losing coherence on the overall architectural quality and integrity of the project.

To mitigate these two risks, it is recommended to include within the design firm's responsibilities a service called "architectural supervision," to be undertaken during the construction phase. Architectural supervision is quality control of the design aspects during construction activities. It mainly consists of answering possible questions related to the design, modifying, or completing the plans if necessary, and advising the client on design issues. Having the design firm on board during the construction phase ensure a continuous technical leadership throughout all phases of the project and ensures any design changes will be done in line with the overall architectural plan.

Rehabilitation of the National School of Guatemala, testimony of the emerging modern architecture of the 1940s in Haiti Photo: Christian Ubertin (IDB)

Types of interventions

Reconstruction versus rehabilitation

Initially, the Program planned to finance both new construction and/or rehabilitation work according to the school's level of damage. However, it soon became clear that the rehabilitation of existing schools (mostly of poor construction quality) to comply with the new standards would have been technically and financially not advantageous compared to new construction. Finally, a limit of expenditure for rehabilitation work was set equal to 60% of the cost of a new construction. All schools for which rehabilitation would cost more than 60% of a new construction should be demolished and reconstructed.

Below are other considerations to keep in mind when evaluating conducting a rehabilitation versus a reconstruction:

Expectations: The decision to demolish an existing structure is often driven by the desire to have a new building, or by the belief that existing buildings are not compatible with the new expected standards, and especially the ones related to the structural performance of the building. However, both rehabilitation and new construction address the same safety concerns, but in different manners.

For rehabilitations, the structural retrofit aims to improve the stability of the structure, to ensure that the building will not collapse during a disaster; while for a new construction, the buildings are expected to withstand disasters without major damage and be immediately available for use after the event. By expecting results that can only be achieved through new construction, the opportunity to rehabilitate buildings at lower cost can be missed.

When opting for standards that can only be achieved through a new construction, the opportunity to rehabilitate buildings at a lower cost can be missed.

Value of use: Rehabilitation should be a natural choice when the building is still considered safe to use under its current structural condition and when the comfort criteria can be improved without affecting the stability of the structure.

Site and environment: If the environment or the site are not adequate, and if the identified risks cannot be mitigated, a relocation and reconstruction may be favored over a rehabilitation. This is particularly true for schools located on sites that are too small, and where the rehabilitation of the existing buildings, even if technically possible, will not be able to address the safety concerns related to the site.

Environmental value: The demolition and reconstruction process often lead to a "tabula rasa" with the destruction of other valuable aspects of the site (mainly trees and longtime landscaping) that should be preserved and integrated in the new project. This can be an argument to opt for a rehabilitation of the buildings or at least to limit the reconstruction project to the area of the old building to preserve the existing environment. This could be done through a "Design Brief" (see Improving the planning and design phases).

Cultural heritage value: Restauration and rehabilitation should be the priority for all buildings having cultural heritage value. Local legislation for the protection and conservation of cultural heritage are normally sufficient to protect classical and traditional architecture built before 1930. Today, heritage and preservation trends are evolving to include 20th century modern architecture (1930-1970), for which there is little or no protection in many countries today. Among the 90 schools constructed in Haiti, two were rehabilitated because of their architectural value. The first one was a 1913 historical building for which preservation was without discussion (see photo p. 7). The second was part of the emerging modern architecture of the 1940's in Haiti, and was saved from demolition thanks to unexpected budget restrictions, and successfully rehabilitated (see photo p. 37).

Temporary structures

Following the decision of the Haitian government to temporarily suspend all permits for permanent construction, during the time to revise and adapt the national building code (2012), it was necessary to rapidly equip the schools with temporary structures. Different models, mostly made locally, were implemented by the Program and other organizations. In only a few cases were imported or prefabricated structures used, except for tents and other emergency shelters.

Local wood structure (three-year lifespan)

This model was implemented at the early stage of the Program. It consists of a basic wood structure placed on a concrete slab and covered by a light roof with open lateral sides. Each module has three classrooms of approximately 50 square meters. The separations between the classrooms are made of plywood. These structures have a lifespan of three to five years and were meant to be used only during the time needed to plan and reconstruct the school.

The basic design was prepared by local contractors using locally available materials and built by local workforces. The light and open structure also provided a perception of safety for children and adults who had been traumatized by closed spaces after the earthquake. These light structures withstood any afterquakes. The disadvantages (i.e., noise, no equipment could be stored in classrooms, etc.) were considered minimal given the emergency context. Other limitations for these light wooden structures are their short lifespan and limited hurricane resistance.

Main advantages of this system were rapid construction and low cost. The Program equipped 58 schools using wood structures in less than two months[1].

Local metallic structure (10 to 15-year lifespan)

This model looks like the wood model, but its structure is entirely made with regular metal sections welded and embedded in the concrete slab, providing the same perception of safety and comfort as the wood model. The walls and inner divisions are made using plywood. This model can also be implemented quickly with local materials and workforces. The greatest difference from the wood structure is a longer lifespan of 10 to 15 years, and better hurricane resistance. An interesting aspect of this metal model is that it can be dismantled and reused somewhere else or reused on the spot (for example, converted as a cafeteria in the reconstruction project (see Table 17).

1 Génie Structures d'Ayiti. (2013 May). Évaluation des structures temporaires fournies et construites sous la tutelle de FAES suivant le séisme du 12 janvier 2010. Rapport et recommandations. Version finale du 20 mai 2013. IDB. Haiti.

Construction of a wooden temporary structure at the Ecole Nationale de Calcutta.Photo: Christian Ubertini (IDB)

Semi-permanent structure (15-year lifespan)

This model is implemented by "recycling" the metal structures used for the emergency tents[33], into semi-permanent structures. The metallic structures of the tents were recuperated and embedded in a solid concrete foundation and covered with a lightweight roof. This model provides the same level of comfort and safety as the two previous models. The classrooms are closed with low walls made with cement blocks, and the quality of the material increase its durability and resistance to wind. The major inconvenience of this model is the mix between a temporary and a permanent solution, which could have the effect to delay the permanent reconstruction. These solutions are also more expensive and might consume a large portion of resources that should be devoted to permanent reconstruction. In Haiti, the use of semi-permanent models created controversy and were not favored by all the stakeholders[34].

33 VAN DE VELDE, Patrick. (2012). Évaluation du Projet de l'UNICEF pour la Reconstruction d'Écoles Semi Permanentes en Haïti. Rapport de Mission. UNICEF.

34 THEUNYNCK, Serge. (2010). Aide-Mémoire de la mission de la Banque Mondiale relative aux questions de génie-civil. Note Technique, p.32.

Considerations for temporary structures

Rapidity and cost-efficiency. Rapidity of construction and cost-efficiency should be the first criteria for temporary solution in an emergency context. Local solutions are often more efficient in terms of cost and rapidity as materials and workforces are already on-site. Imported or prefabricated solutions such as tents or containers need to be selected carefully as they are usually not adapted for hot climate regions like Haiti.

Lifespan. Depending on the material, different lifespans can be obtained. This greatly influences the reconstruction strategy: a longer lifespan may delay permanent reconstruction, while a shorter lifespan might be an incentive to rebuild the school within a two-year to a maximum of three-year period.

Reuse options: The reusable model can be either reused in another site or recycled in a reconstruction project, as a covered space for different outdoors activities or as a cafeteria. To do so, it is important to carefully choose the location of the temporary structure on the site from the beginning, so it will not be an impediment to the construction of the new buildings.

The wood model.

The semi-permanent model.

Reuse of metallic model

Table 17. Examples of various temporary structures constructed in Haiti after the 2010 earthquake. Photos: C. Ubertini and UNICEF (The semi-permanent model).

The construction system was made using a structure of light-gauge steel elements that were prefabricated in a factory in Port-au-Prince. The metal sheets were shipped in rolls and brought to the workshops after clearing customs. During the prefabrication, another team was preparing the concrete foundations on the sites following traditional techniques. The prefabricated elements were then transported to the sites and assembled by trained labors with specific tools. The elements were then covered by either plasterboard or sprayed concrete, requiring specific machinery. The light-steel structure is earthquake-proof due to its lightness and ductile behavior

Table 18. Light-gauge steel prefabricated system used by the Program. Photos: FAES.

Prefabricated solutions

Among the 90 schools built by the Program, 10 schools were awarded to an international firm proposing prefabricated building solutions (see Table 18). This international firm, along with other two local firms using traditional on-site construction systems, successfully completed the construction of the 10 schools, in the same time frame, suggesting that both technical systems are equally efficient in terms of construction speed. The prefabricated solution proved to be competitive but not cheaper than a traditional on-site construction (see Table 19).

Costs and time frames being relatively similar, the suitability of prefabricated solutions versus traditional on-site construction must be analyzed through other indicators, mainly related to immediate and long-term impacts for infrastructure and for the population.

Social demand for labor-intensive works

Prefabrication is defined as the construction in a factory, off-site, of large parts of the buildings, such as structures, walls, roofs, and their delivery, and assembly on-site. Compared to the traditional on-site construction, prefabrication requires a higher capital investment to produce the elements and to import the required material and skills. In Haiti, as in most other developing countries where labor-costs are low, prefabrication is not well developed, and remains a niche market, mainly proposed by foreign companies. Despite some companies having established factories to serve the massive reconstruction demand after the 2010 earthquake, prefabricated systems remain a niche market in Haiti.

Prefabrication and the mechanization of construction processes (excavators, concrete pump trucks, etc.) are often seen by the population with skepticism, since they replace dozens of workers who can perform the same work manually.

The author recalls a situation when a community prevented a pump truck from entering a construction site to cast an 80 m3 concrete slab. They demanded that the slab be cast in the traditional way, with concrete prepared on-site and transported with buckets that passed from hand to hand through a 20-meter-long human chain. The job took two days instead of one with the pump truck, but it provided work for 60 people instead of five.

In Haiti, prefabrication, as well as mechanization of construction processes, are often seen by local populations as being against their interests, since they replace dozens of workers who can perform the same work manually.

In Haiti, construction projects present rare job opportunities for local communities. There is a strong social demand for labor-intensive works that only traditional on-site construction using common techniques and skills can provide.

Cost and construction time

As we have seen above, cost and construction time using prefabricated solutions in Haiti did not prove to be more advantageous than traditional on-site construction using locally available materials and skills. This for various reasons:

1. Imported materials are, by definition, not stocked in quantity in the country and need to be transported by road or shipped. Generally, command and transportation only begin when the contract is signed. Clearing materials through customs can be difficult if the importing firm is not yet well established in the country. Time for clearance is uncertain and can be long, which leads to increased costs and delays.
2. Prefabrication concerns only a part of the building, namely the walls and the roof. Site preparation and concrete foundations need to be constructed on-site following standard techniques. Generally, these on-site works are subcontracted to a local firm, resulting in additional costs for the company.
3. Issues related to logistics, distribution, and remoteness of sites caused bigger delays than the time the firm could save by prefabricating elements in the factory.

Maintenance and repairs

The major inconvenience of prefabricated systems is the limited ability of the final users (school, local community, MENFP, etc.) to maintain and repair the building at lower cost after the construction. Original materials might not be accessible and specific skills not available anymore.

Working with an international firm

The main difference between prefabricated and traditional on-site construction was not the construction system, but it was more likely related to the international aspect of the firm that implemented this system. Thanks to solid administrative and financial capacities, international firms can respond to unexpected situations and to mobilize international skills, in country and abroad, on demand and in a timely manner. This has allowed the firm to implement and coordinate the different activities autonomously, without being affected by external factors. Final designs were made during the importation of the material. Foundations were prepared on-site, while elements were prefabricated in the factory. The coordination of parallel activities is normally a greater challenge for national firms, as they are more dependent on local resources and skills.

	Origin	Contract signed	Inauguration date	Construction system	Nb of school	Amount in US$	Average / school
Firm 1	National	Jan. 2014	Mid 2016	On-site masonry	9	6,476,364	719,596
Firm 2	International	2013	Mid 2016	Prefabricated	10	9,029,857	902,985
Firm 3	National	Nov. 2013	Mid 2016	On-site masonry	10	9,947,701	994,770

Table 19. Comparison of 3 different firms using different construction systems. Source: IDB.

Water, sanitation and hygiene equipment

In terms of Water, Sanitation, and Hygiene (WASH) standards, the school norms were aligned with the standards established by the *Direction Nationale de l'Eau Potable et de l'Assainissement* (DINEPA) and promoted at the MENFP level by the *Direction de la Santé Scolaire* (DSS)[35].

"Clean" and "drinking" water

According to the 2014 school census, only 50% of the Haitian schools have a good access to "clean" water, meaning they have the necessary equipment to collect, store, treat, and distribute "clean" water, mainly used for cooking, handwashing, cleaning, and flushing toilet. "Drinking water", which is not included in the previous statistic, is managed on a case-by-case basis by the schools. Most of the time, students are responsible for bringing their own bottle of drinking water or for buying small plastic bags of water from the street market.

Each school built by The Program has been equipped with underground concrete water tanks to store a minimum of 9,000 gallons (approximatively 34 m3) of "clean" water, to be collected by different means: DINEPA network, water trucks, rainwater harvesting, well, etc. This covers an average consumption of 4 gallons per person, per day. "Clean" water is treated with little quantity of chlorine and mainly used for cooking, handwashing, cleaning, and flushing toilet. Schools have also been equipped with solar pumps to store water in intermediate tanks of 300 gallons placed in height, so the supply of the various water points can be done by gravity in case of momentary absence of electricity.

Sanitation

Each school built by The Program has also been equipped with sanitary facilities organized in separate units for the different group of users, as per the following requirements:

- Girl's unit: 5 toilets (including 1 for students with disabilities), washing basin.
- Boy's unit: 4 toilets (including 1 for students with disabilities), 6 m of urinal, washing basin.
- Adult's unit: 1 male cabin, 1 female cabin, washing basin.
- Preschool's unit: 1 collective cabin with 2 toilets, 1 shower, washing basin.

Different wastewater systems for sanitary facilities have been implemented by The Program:

The first one, mainly implemented in urban and peri-urban areas, is the traditional septic tank system, where the sludge is kept in a sealed space and need to be emptied regularly with mechanical means (trucks) and transported to official treatment areas.

The second system (see plans in annex) has been designed for school located in rural areas where the sludge treatment means are limited, posing environmental and health threats. This system is designed with alternate double pit (also known as fossa alterna) where the sludge is composted for 6-12 months in a first sealed and ventilated pit, though avoiding soil infiltration (no open pit) and facilitating the reuse of the composted mixture, harmless for the people and for the environment, while the second one is in use. This wastewater system construction was accompanied by training and promotion activities with the school users. Nevertheless, this system was not always accepted by the school community and in some cases had to be modified on site and turned into traditional septic tank systems.

Photo: Christian Ubertini (IDB)

35 Directive pour la promotion de l'Hygiène en milieu scolaire. Direction de la santé scolaire (DSS), MENFP, 2012.

The new National school of Cabaret.
Photo: UTE

Improving the planning and design phases

Verifying the feasibility of the project[36]

The Environmental and Social Analysis (ESA)

Following IDB procedures, the completion of an Environmental and Social Analysis (ESA) is generally the only preliminary study mandatory at the stage of the proposal for operation development (POD). The ESA aims to identify and assess potential impacts and risks of the construction project on existing environmental and social conditions and vice versa. The results of the ESA inform an Environmental and Social Mitigation Plan (ESMP) to be implemented during the operation's execution. The ESA will classify the project under three categories (A, B or C) depending on the level of the potential risks and impacts[37].

36 "Do it Here, Not There: Guide for the Selection of Land to Build Social Infrastructure" provides useful recommendations for land selection for social infrastructure projects.

37 IDB ESG Policy B.3 Screening and Classification.

Generally, social infrastructure projects in Education are classified in the B category, mainly because of the environmental and social impacts related to the construction activity (e.g., demolition, and general construction issues, tree felling, waste management, employment opportunities, protection of workers, gender integration, community participation, etc.).

ESAs were elaborated for the 90 schools included in the Program and identified mitigation measures (e.g., improving access, site protection, etc.) that were implemented through a specific budget line.

Verification of site's dimensions and adequacy

Having a verified and suitable site must be a prerequisite for any construction project. Verification should be done at the POD level when possible. However, this verification is rarely done, and it is not included in the usual tasks of an ESA, although it is complementary assessment that should be done within or in parallel to the ESA.

Cat. A	Category A projects are likely to cause significant negative environmental and associated social impacts or have profound implications affecting natural resources. These operations will require an environmental assessment (EA), normally an Environmental Impact Assessment (EIA) for investment operations, or other environmental assessments such as a Strategic Environmental Assessment (SEA) for programs and other financial operations that involve plans and policies. Category "A" operations are considered high safeguard risk. For some high safeguard risk operations that, in the Bank's opinion raise complex and sensitive environmental, social, or health and safety concerns, the borrower should normally establish an advisory panel of experts to provide guidance for the design and/or execution of the operation on issues relevant to the EA process, including health and safety
Cat. B	Category B projects are likely to cause mostly local and short-term negative environmental and associated social impacts for which effective mitigation measures are readily available. These operations will normally require an environmental and/or social analysis, according to, and focusing on, the specific issues identified in the screening process, and an environmental and social management plan (ESMP).
Cat. C	Category C projects are likely to cause minimal to no negative environmental and associated social impacts. These operations do not require an environmental or social analysis beyond the screening and scoping analysis for determining the classification. However, where relevant, these operations will establish safeguard, or monitoring requirements.

Table 20. Brief description of Environmental and Safeguard project classification as per Policy B.3 Screening and Classification. Contribution: Sarah Mangonès, IDB/ESG.

The objectives of verification are:

1. Physical assessment: Verifying the physical capacity of the site (in terms of dimensions, slope, access, location, nuisances, and adequacy) to create a safe learning environment around the school taking into consideration appropriate site density criteria.
2. Logistics assessment: Verifying the possibility to carry out construction work while a school is in operation and/or if the educational activities need to be temporarily relocated during construction work. If relocation is needed, options need to be identified at an early stage and secured before the start of the project.

This analysis requires specific inputs from a consultant who will be able to produce schematic plans or a preliminary master plan to verify and demonstrate the site's adequacy. These are regular tasks included in a preliminary study called "Design Brief" or "Feasibility Study".

The site density issue

In Haiti, the land use issue is acute. Too many schools are located in areas that are too small to rebuild a school that has the capacity to respond to the actual and future enrollment needs. This situation is particularly dramatic in urban areas where public schools are overcrowded and should not be extended without a substantial extension of their land. Nevertheless, the lack of space does not impede construction activities. Schools continue to grow either by adding levels to existing buildings or by building new classrooms in the courtyard. The extensions reduce the recreation area and evacuation routes, decreasing safety levels in the event of an emergency.

The enrollment capacity of a school should be in line with the capacity of the site to evacuate, in case of emergency, students and staff to a safe open area within the school compound. This safety area must be calculated so that, once the buildings have been constructed, the remaining circulation and outdoor spaces are sufficient to manage the flow and gathering of students in a central courtyard.

The dimensioning of the central courtyard and the evacuation path leading to it will determine the level of safety of the school site.

Haitian norms, like similar norms in other LAC countries that were reviewed, do not specify the minimal surface for such a safety area. Only the playground area (which should be larger than the minimum safety area) is specified as 2.6 square meters per student in urban areas. Nevertheless, the reality of the urban sites in Haiti makes these values often not applicable.

The analysis of existing urban schools with a central courtyard considered reasonably safe to gather students in case of emergency, suggests that the minimum ratio for the safety area should not be less than 1.2 m2 / student, meaning a surface of approx. 500 m2 for a 9+2 school with 410 students (Table 21 and Table 22). Below this value, the school could be considered unsafe and investment in such a site should be reconsidered.

Design brief or feasibility study

The results of the site and environmental assessments are part of a feasibility study also called "Design Brief." The Design Brief is an extended Term of Reference for a construction project design.

	Recommended	Minimal
Land size	6,000 m2	4,000 m2
Area per student	12.5 m2 /student	7.5 m2 / student
Playground area	2.6 m2 / student	2.2 m2 / student
Safety area	2.6 m2 / student	1.2 m2 / student

Table 21. Land surfaces and minimum safety values. Source: Guide pratique

A: Actual land for the school. approx. 1,200 m2
E: Extension needed to comply with norms of 4,000 m2 (for single-level buildings)
S: Safety area of 300 m2 allowing a max. 360 students in the school (1.2 m2 / student)

Table 22. Example of an existing urban school where the capacity has been reduced according to the site conditions. Illustration: C. Ubertini.

Its main objectives are:

- Verify the feasibility of the project in terms of program, site adequacy, and budget
- Define design criteria for both site organization and infrastructure
- Prepare the Terms of Reference for the design phase

The Design Brief will produce, among others, at least one scenario of a master plan showing a possible organization of the site, with all infrastructure components and outside areas. The main advantage of the master plan scenario is to confirm that the site does have the requested dimensions to accommodate the project. The Design Brief will also be able to identify natural or built elements on-site (i.e., natural areas, trees, heritage objects, etc.) that should be preserved. In this sense, the Design Brief is a complement to the Environmental and Social Analysis that does not specifically investigate the physical aspects of the site.

Design Brief and preliminary master plan are complementary products annexed to the Terms of Reference. They confirm the feasibility of the project on a given site through schematic plans, before investing in further design and construction activities. They should be requested for any construction project.

The Design Brief is annexed to the ToR for the design phase and includes at least the following information:

- Presentation of project, objectives, and approach
- Description of needs (architectural program) and a chart showing the relation between the functions
- Expected standards (structural, energy savings, etc.)
- Densification allowance (max. allowance for constructed area, min. outside area, min. green area)
- Design guidelines (user-friendly, climate responsive design, preferred materials, innovation, etc.)
- A master plan showing a proposed organization of the site according to client's needs (access and circulation, parking location, volume allowances, minimal ratio of green area, non-constructible areas, etc.)
- A preliminary cost estimate +/- 25% based on reference cost /m2

Developing a Design Brief is a good practice and should become a prerequisite for any construction project. Ideally the Design Brief should be done at the POD level (like an ESA) or, at least the preliminary study level. A Design Brief can be created by an architect through a consultancy contract.

The new National school of Dubuisson.
Photo: Alison Elias (IDB)

Pre-design and prototypes

An option often used to minimize the risk of inappropriate design with the "Design and Construction + Supervision" delivery method, is to provide a pre-design or a prototype prepared before the tender process, to be finalized by the winning firm under an adapted version of the "Design and Construction" contract. The "pre-design" is an ad hoc design used for a single project whereas the "prototype" is a model intended to be replicated in other sites. Specifications and indicative Bill of Quantity (BoQ) can also be elaborated and included as a suggestion in the tender documents. The more the pre-design is developed before contracting the construction firm, the easier it will be for the winning firm to finalize it and start construction. In Haiti, the prototypes have been fully developed as ready-to-use construction documents.

Advantages: In Haiti, the gradual incorporation of pre-validated prototypes in the Program, has made the "Design and Construction" method more efficient, in terms of quality, construction time, and supervision. The design scope of the winning construction firm was limited to the adaptation of the prototype to a specific site, through a master plan organizing the school in a child-friendly environment. The prototype had also significant advantages on the general project management, making the costs uniform, simplifying the supervision, and increasing the pace of construction as the firms became more familiar with the models.

Time and process: Prototype design for school construction should be part of the country's planning tool to manage school infrastructure, especially in case of high demand requiring an up-scaling construction strategy. Designing prototypes must be an inclusive and interdisciplinary process, involving different skills and actors (e.g., planners, educators, managers, contractors, donors, etc.). Prototypes should be elaborated prior to the project implementation. However, if a prototype needs to be developed, revised, or adapted within the project execution, it would be reasonable to allow a period of six to 12 months for this activity, including project development and the inter-institutional consultation, validation, and approval procedures.

Design criteria: The key design criteria for a prototype are:

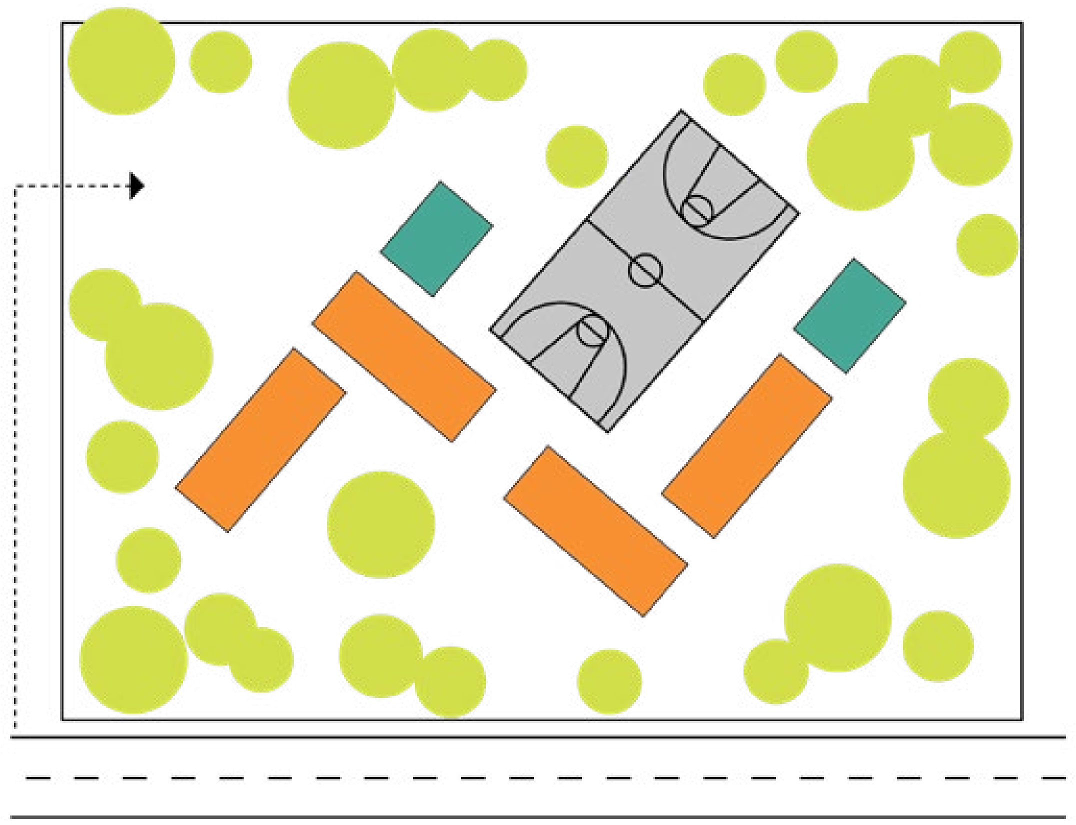
1. *Modularity:* Buildings should be compact enough to be placed with flexibility in all kinds of sites (the Haitian models are two to a maximum of three classrooms in a row).
2. *Replicability:* The prototype should be financially and technically accessible to Small and Medium Construction Enterprises (SMCEs), using locally available materials and systems that can be implemented by local workforces. Replicability also guarantees better maintenance of the infrastructure.
3. *Cost-competitiveness:* The prototype's cost should be competitive with other designs proposed by the sector.

Adaptation needs: Prototypes are only a part of the school construction project, not a final project design. The prototypes are single buildings that need to be well adapted to a specific site to create a child-friendly learning environment. In Haiti, the success of the prototypes led EUs and construction firms to believe that the construction of a school could be done without any other design input, and without architects. This was a mistake. As a result, many projects using the prototypes had well engineered buildings but poor-quality environments, as their outdoor areas, playground, and other landscaping aspects were neglected. Adapting prototypes to a specific site by the winning firms includes the following main tasks:

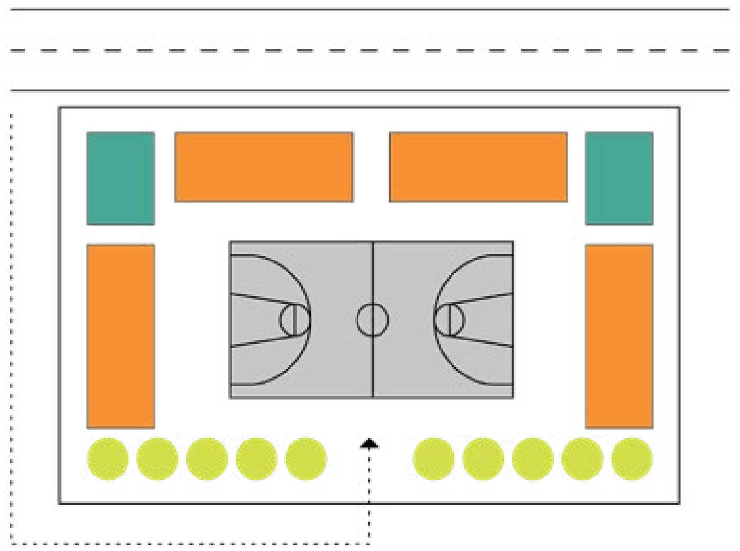
- Elaboration of a master plan organizing the buildings (prototypes) and outdoor areas to create a child-friendly learning environment
- Geotechnical studies to assess the need of reinforcing/adapting the foundations of the prototypes following the soil conditions
- Identification, design, and calculation of all additional site-specific infrastructures such as: enclosing wall, retaining wall, drainage, access roads, etc.
- Elaboration of a consolidated BoQ and cost estimate including the prototypes and complementary infrastructures

Geotechnical risk: In case of unclear site conditions (i.e., soil, drainage, slope, etc.) where the extent of adaption work is difficult to foresee, there is a need to mitigate this geotechnical risk that could lead to delays, claims and expensive contracts at the end. That could be achieved by a Progressive DB contract with a scope validation period. The progressive DB contract consists of a two-phase, fixed value contract. The first phase is for the Design-Builder to provide design and preconstruction services up to a point where the specific work packages can be priced (here: all site-specific work packages). At which point the Design-Builder negotiates a Construction Agreed Price (CAP) price and, if approved by the owner, then a Notice to Proceed (NTP) for the second phase is issued and the Design-Builder is able to start construction. The owner reserves the right to not proceed with the second phase is a CAP is not agreed upon. A scope validation period allows the contractor to incorporate any Differing Site Conditions (DSC) early in the project. No DSC claims are allowed outside of this period.

Innovation: The prototype approach does not necessarily aim to create the most innovative and attractive architecture, but rather a cost-efficient solution, which is useful in a high-demand context, where standardization becomes necessary to ensure minimal quality and a better cost control. This standardization might be counterproductive in a country where the design and construction capacities are competitive and creative. To achieve innovative and quality prototypes, the option of launching an architectural competition could be considered.



Dynamic form for large site



Concentric (static) form for small sites

Table 23. Examples of organization for schools depending on the site's capacity. Illustration: C. Ubertini.

Preliminary master plan

For multiple projects using prototypes, as well as for single projects using the “Design and Construction” delivery method, it is highly recommended to have a mechanism to verify and validate a preliminary master plan before the bidding process. This practice helps verify the feasibility of the project on a chosen site, suggests a recommended spatial organization, and provides the bidding firms with a common reference for their bids.

As this was not done early in the process in Haiti, the spatial organization, and the outside areas of some of the schools have been poorly addressed during the implementation of the Program. The classroom buildings were placed on the site without an overview of the entire school compound and without considering outdoor areas as being part of the school’s learning environment.

As a result, most of the schools follow the traditional “concentric or static” form of spatial organization, where the buildings are aligned and arranged around a central courtyard. This form of organization is adapted for small sites as they have the advantage of being compact. However, it has the disadvantage of offering very few external subspaces for educational purposes. In larger sites, a more dynamic form of spatial organization is preferred, where different subspaces can be created. Here, the buildings can be placed away from fences and obstructions, transforming the center of the plot into green space and optimizing the orientation of the buildings according to the characteristics of the site (i.e., winds, existing trees, sunlight, view, etc.).

The preliminary master plans would help improve this aspect of the design and better communicate the site organization preferences to the firms.

The National school of Herbe-à-Flèche
Photo: Alison Elias (IDB)

The administration building at the new National school of Chansolme
Photo: Alison Elias (IDB)

Improving the project monitoring

The success of a construction project depends on both the performance of the firms/consultants and on the leadership of the client/owner via its EU. This leadership is a mix of technical and managerial capacities, as well as a high level of project ownership. Leadership and project ownership can be verified in the following two areas:

- Capacity of the EU to take and communicate timely and sound decisions in the interest of the project (quality, costs, and efficiency)
- Degree of presence of the EU on-site during construction work to demonstrate interest in the final product.

In Haiti, most bottlenecks affecting IDB-financed construction projects can be attributed to the EU's weak technical leadership and project ownership.

Technical leadership and project ownership

In Haiti, as in other countries were the IDB operates, the EUs are organized and trained mainly to launch and close activities, manage contracts, conduct procurement processes, and monitor disbursements. To execute these tasks according to the requested standards, the IDB organizes a series of trainings, certifications, and refreshers to strengthen the EUs' managerial capacity. However, there is nothing similar yet to reinforce their technical capacities to monitor and supervise construction projects. As a result, technical aspects (planning, design criteria, feasibility, environmental issues, costs, timelines, etc.) are delegated to external consultants, often with little guidance and quality control from the EU. Consultants and firms end up working individually without proper coordination necessary to align the technical choices with the requested quality and operational objectives. The risk is high for the Execution Unit to progressively lose control of the project.

In Haiti, the consequences of this situation were: Inappropriate design; incomplete technical project documentation; underestimated time frames and costs resulting in numerous contract amendments, leading to endless negotiations with the firms; and a substantial increase in costs and delays.

There are several measures that can be taken to reinforce the technical leadership and project ownership of the EUs, as described below.

Recruitment and profile of team members

The project management team for a construction project is usually composed of one or two qualified architects/engineers for the technical aspects (design, and technical verification) and one manager for the coordination of the activities. But to reinforce the technical leadership and project ownership, it is essential that there be an affinity or a personal interest in the final product. In the case of a school construction project, the result is not the engineering product but the pedagogical tool that the whole school (building and environment) represents for the student's learning. This means that the project should be designed from the start having in mind the learning environment's functionality, including soft aspects such as landscape, playground, colors, light, design furniture, etc.

In Haiti, the EU team members were not recruited for their interest in children's pedagogy but primarily for their construction experience. A team member with less experience in construction but with an expertise or personal interest in pedagogy would have definitively been an added value for the project. He/she would have allowed the EU to better lead the design process and to ensure a better presence on-site during the construction phase.

If the project team do not have the requested expertise/interest, a consultant could be hired to lead the design process.

Training

Training helps build capacity, share experiences, convey messages on lessons learned, raise awareness, and build good working relationship among project partners, etc. Training can also help create ownership if it is oriented to the project's vision and philosophy and not only on procedural guidelines to follow.

Other than the numerous and valuable knowledge products elaborated by the SIU[38], there were few or no guidelines promoted by the IDB for construction projects. There were no minimal standards defined for the architectural quality of a project, and no defined procedures to elaborate, analyze, and validate the project design. As a result, there are still no specific trainings on construction project management for implementing partners.

In Haiti, several multi-disciplinary training and coaching sessions with the partners (IDB team, Execution Units, supervision, and construction firms) were held. These proved to have a positive impact on the collaboration between the different parties. These trainings have also contributed to raising awareness on the importance of the "soft" aspects (pedagogical, environment, playgrounds, etc.), and resulted in an improvement of the landscaping and other soft aspects of the project.

Training provides value before and during the project implementation. It would be useful for future projects to provide specific trainings on construction project management, specifically, in the following areas:

- How to better prepare the construction project (design brief, feasibility study)
- How to identify the key challenges of a project (functionality, environment, standards)
- Identifying key aspects to be verified in a project design

38 See Annex for full list of publications.

Photo: Alison Elias (IDB)

- How to analyze the technical and financial offers of the firms
- How to monitor costs and delays during the construction site
- What to check during an inspection of ongoing works (scope, quality, schedule)
- Presentation of reference projects.

A regular presence of the client/ owner in the site

During the construction phase, the client via its EU, performs regular visits to the construction site to assess work progress. These visits are important for the smooth running of the construction, as they contribute to maintain open communication with the firms and a good working environment between all parties. However, EUs tend to underestimate the importance of these visits, limiting their presence on the site to the strict minimum, at the beginning and at the end of the work, or when an unexpected issue requires their presence on-site. By doing so, the EU can lose contact with the reality on the ground, communication with the firms, and leadership on the project.

Experience shows that a strong presence of the client/owner on-site has a positive impact on the firms' commitments, leading to a significant improvement quality and construction pace. This presence allows the EU to anticipate any problems that might occur and have a timely response to any complaints from the construction firm.

The experience with the first group of schools, where 19 construction sites were accumulating delays and firms were demotivated and demobilized, led the EU (FAES) to strengthen its supervision capacities with an additional team of engineers entirely dedicated to paying weekly visits to all construction sites[39]. This change contributed to restoring the EU's technical leadership and was rewarded with a spectacular change of attitude from the firms. Work resumed on the 19 sites, and the construction of the 70 schools of the two first operations was completed without major issues.

EU In-house supervision

Under certain conditions, the supervision of work can also be done internally by the client via its EU. The in-house supervision by the EU is certainly a good approach to increase project ownership for small constructions and/or non-complex projects. It reduces the number of intermediaries between the site and the client. The Program used in-house supervision in specific situations when there were no supervision firms on board.

This approach requires a specific set-up from the EU with a dedicated supervision team. The supervision team must be deployed full time on the site to direct the work, document daily activities, issue reports, and request payments. It must also have the necessary tools or mobilize the necessary capacities (e.g., geometer, analysis of material, etc.) to perform quality checks. It is also important that the in-house supervision team can mobilize external experts (engineers, architects) to provide support.

The feasibility of an in-house supervision must be assessed on a case-by-case basis, depending on the set-up and capacity of the EU.

IDB technical support

The team leader representing the Bank should maintain an open and active communication channel with both the team leader and the coordinator of the EU, to make sure any shortcomings are known and addressed in due time.

Capitalization of experiences and lessons learned

Lessons learned methodology aims to collect, validate, consolidate, and document experiences, tips, mistakes, and risks found during a project[40]. The lessons learned lead to recommendations on good practices to achieve specific results in a specific context. They also help to better understand the reality in the field, and to formulate reasonable objectives when preparing a new project. The lessons learned approach is opposed to the "best-case scenario" approach, which tends to ignore the reality in the field, to seek the ideal implementing conditions serving overly ambitious objectives.

The main instruments to collect and validate the lessons learned are the project evaluation reports, such as Mid-Term Review (MTR) and Final Project Evaluation (FPE). In Haiti, in addition to the MTR and FPE, the following documents have been developed to complete the evaluation reports (see bibliography):

- This publication
- A working paper on an alternative strategy for school construction based on experiences and lessons learned
- The "guide pratique" for school construction in Haiti that includes a section on recommendations based on lessons learned
- A document illustrating the frequent errors observed on the construction sites.

39 The Quality Control Unit (UCQ) at FAES.

40 https://www.shareweb.ch/site/Learning-and-Networking

The availability of lessons learned does not guarantee that they are applied or even considered when implementing or designing new projects. In Haiti, the regular turnover of human resources in the project management team, the multiplicity of actors, the absence of a central agency for school construction, and the weak coordination mechanism at central level, lessen the impact of lessons learned. As a result, after 10 years of investment in school construction, and despite the 200 schools built with the help of donors, the lessons learned have not yet been endorsed by the sector. Therefore, there is no guarantee that future similar initiatives in Haiti will avoid repeating already identified and known errors.

The following suggestions can improve the sharing of the lessons-learned:

- Endorsement of the relevant lessons learned documents by the sector, and make them available in the MENFP website and the IDB internal library
- Mention and quote relevant lessons learned documents in official project preparation document such as POD
- Adapt the Term of Reference of each project team member (at the EU and at the IDB) requesting them to evaluate and question new strategies and scenario considering relevant lessons learned
- Ask project evaluators to review and update the existing lessons learned

The National school of Aquin
Photo: Alison Elias (IDB)

3. Recommendations based on learnings

The following recommendations are based on the learnings from the Haiti school construction program. They are intended to improve future projects executed in a fragile context like Haiti. These recommendations are not intended to be directives, but rather show options to mitigate specific risks during the implementation. They also aim to raise awareness on conditions associated to each approach to the project.

Strategy and delivery method

1

Choose the delivery method according to the importance you want to give to the design and overall architectural quality of the project, and if the client/owner or the IDB, needs/wishes to see and validate the project design before the tendering of the construction firm.

p. 35 Table 15

2

Choose Design and Supervision + Construction (DS + C) when: i) projects ambition a qualitative architectural response such as for most of social infrastructure projects (schools, health care centers, hospital, offices, etc.); ii) the site's complexity and existing environment need to be carefully analyzed and planed with the infrastructure (slope, dense vegetation, existing structure to maintain, etc.); iii) you want to promote innovation, energy efficiency, climate responsive design, etc.

p. 31

3

Choose Design and Construction + Supervision (DC + S) when: i) projects do not seek qualitative and customized architectural designs (such as temporary structure, warehouse, industrial spaces, etc.); ii) the environment is not constraining (flat and empty sites already planned for construction); and iii) market-based solutions, or specific products used by the firm (prefabricated system, etc.) are considered sufficient.

p. 31

4

When one of the above conditions is not met, the DC + S method must be accompanied by preliminary design documents such as: i) for single project: design brief or preliminary project design; ii) for multiple projects: pre-validated prototypes and preliminary master plans for each site.

p. 44, p. 46

5

With DC + S, note that the absence of detailed technical documentation before the bidding might lead to higher costs (to cover unexpected changes) and delays during the construction phase if unforeseen works need to be designed and negotiated.

p. 31

6

Choose the separated method Design + Construction + Supervision (D + C + S) when: i) projects have a higher complexity (e.g., hospitals, high technology buildings, etc.); ii) when the supervision capacity of the design firm is weak and a specialized supervision firm is preferrable (especially for multiple projects).

p. 36

7

In the D + C + S case, it is important to keep the design firm on board throughout the construction phase via a service called "architectural supervision." This is a quality control of the design aspects during construction activities, consisting in answering possible questions related to the design; modifying or completing the plans if necessary; and advising the EU on design issues.

p. 36

Procurement and selection of consultants/firms

8

Large-batch vs. small-batch: The large-batch approach requires higher financial and technical capacity from the construction firms compared to the small-batch approach, though restraining the participation of a larger number of contractors and limiting the local competition. The large-batch approach also proved to be approximately 20% more expensive than the small-batch approach (comparison ARSE 19, ARSE II and AMOPERE).

p. 33

9

Large-batch vs. small-batch: The large-batch approach within a DC + S scheme, without preliminary design documents, should be avoided. This method tends to generate inconsistent offers with underestimated or overestimated costs, since the firms are unable to prepare detailed and realistic offers for several objects within the usual time frame of the tender (45-60 days).

p. 33

10

Large-batch vs. small-batch: Choose the small-batch approach (maximum of two to three schools) to maximize firms' participation and competition, and guarantee compliance with contracts. Even if this this approach creates a larger number of contracts to manage, it will be rewarded by less burden during the construction phase.

p. 33

11

Expression of Interest (EOI): The EOI is mandatory and a key phase for shortlisting Design Firms (under DS+C or D+C+S) and/or a construction firm (under DC+S) for any construction projects that seeks specific architectural standards. The EOI should synthetically describe the project and provide link to the Design Brief or any other document that describes the project's characteristics and expectations. The shortlisting of firms should be based on experience and capacity, as well as an evaluation portfolio of similar projects.

12

Portfolio of project: This is a presentation of projects built by the consultants/firms that includes pictures and technical data. The portfolio allows the client to see at a glance the orientation, expertise, and added value of the consultants/firms for a specific project, in terms of architecture, innovation, environmental concerns, etc. In this sense, the analysis of the portfolio guarantee that shortlisted consultants/firms have the adequate experience and competence for the project.

13

Portfolio of project: Portfolio of project can also be requested as part of a standard Request for Proposal (RFP for DS+C and or D+C+S), or Request for Bids (RFB – for DC+S), for better evaluating the consultant or the firm's profile for a project design.

Note: If necessary, an external consultant (external architect, or the design brief firm) can be hired to assist the EU in evaluating proposals and portfolios.

Type of intervention

14 **Rehabilitations:** Rehabilitation should be the best choice when the building is still considered safe to use under its current structural condition and when the comfort criteria can be improved, at reasonable costs (up to 60% of a new construction), without affecting the stability of the structure.

p. 37

15 **Rehabilitations:** The formulation of the rehabilitated building safety requirements is crucial. By having the expectations that can only be achieved through new construction, the opportunity to rehabilitate valuable buildings at lower cost can be missed.

p. 37

16 **Rehabilitations:** The main criteria to inform the decision to rehabilitate are: i) current safety/comfort of the building; ii) overall value of the building and of its natural environment (architecture, landscape, trees, heritage value, consistency with the immediate urban environment, etc.); iii) comparison of prices between rehabilitation and new construction up to a predefined percentage (in Haiti it was 60%).

p. 37

17 **Temporary structure:** When choosing a model for temporary structure after a disaster, be aware that the lifespan of structures might greatly influence the reconstruction strategy: a longer lifespan might delay permanent reconstruction while a shorter lifespan is an incentive to rebuild the school within a short period and saves resources for permanent reconstruction scope. On the other hand, if short lifespan temporary structures are not followed in time by construction of permanent structures, there is a risk that users stay longer than expected in a no longer appropriate structure.

p. 38

18 **Temporary structure:** If choosing a model with a longer lifespan, such as metallic structure, opt for a system that can be easily dismantled and reused, or integrated in the future project as covered area for refectory or playground. Avoid metallic structures in a saline environment such as the coastline.

p. 38

19 **Prefabricated solutions:** In Haiti, prefabricated solutions did not prove to be faster or cheaper than traditional on-site construction, mainly because of logistics issues (difficulty to import the material from abroad and to transport the prefabricated elements on the remote sites), and the fact that a part of the works (land preparation, excavations, and concrete foundations) are built on-site with the same challenges of traditional construction.

p. 40

20 **Prefabricated solutions:** Prefabrication and the mechanization of construction processes go against the social demand for labor-intensive work that only traditional on-site construction can provide.

p. 40

21 **Prefabricated solutions:** The maintenance of schools built with prefabricated systems remains a concern, because of the non-availability of the imported material in the local market. When choosing a prefabricated system, limit the use of prefabricated elements for components that will are less likely to require maintenance, such as the inner structure or the roof. Avoid using imported materials for all secondary elements such as doors, windows, furniture, etc.

p. 40

Preparation and design

22 **Preliminary studies:** undertake (i) topographical survey: Ensure that you have a topographical survey in digital format at the beginning of the planning process. The topographical survey will be necessary for the consultant who will develop the Design Brief; (ii) geotechnical studies, to ensure that the soil is apt for construction at reasonable cost.

23 **Design Brief:** The "Design Brief" or feasibility study, aiming to verify the feasibility of the project in terms of program, site adequacy, and budget, must be a prerequisite for all construction projects. It must be developed at a very early stage of the project, ideally at the POD level, or at the preliminary study phase at the latest before launching the project design. It must be annexed to the ToR for the project design.

p. 44

24 **Design Brief:** The consultant for the Design Brief preparation should be an architect able to identify the main architectural and environmental challenges of a construction project and willing to explore different scenarios to frame the project design. He/she must be selected based on a project portfolio demonstrating his/her adequacy to the project finality.

p. 44

25 **Design Brief:** Pay attention to the site density issue. A too small site with limited outdoor areas might represent a safety risk. The ratio between the constructed area and the open area should be determined in the Design Brief to avoid a hazardous densification of the site. The compliance with this ratio must be a condition for the project design validation.

p. 43

26 **Preliminary design and BoQ:** When choosing a DC + S delivery method for a single project, evaluate the necessity to provide the firms with a preliminary project design and a BoQ (including the master plan) that would ensure a minimal design quality and minimize the risk of receiving underestimated offers from the firms (see recommendation no. 4).

p. 46

27 **Prototypes:** When choosing a DC + S delivery method for a multiple project, evaluate the necessity to provide the firms with pre-validated prototypes and BoQ, to improve the overall efficiency of the project, in terms of quality, construction time, and supervision.

p. 46

28 **Preliminary master plan:** For multiple projects using prototypes, as well as for single projects using the "Design and Construction" delivery method, develop a preliminary master plan before the bidding process. This will help verify the project's feasibility on the site, suggest a recommended spatial organization, and provide the bidding firms with a common reference for their bids.

p. 46

Improving project monitoring

29 **Leadership:** The success of a project depends on both the performance of the firms, as well as the leadership and project ownership by the client/owner via its EU. Several measures can be taken to strengthen leadership and project ownership by the EU, as described in the following recommendations

p. 49

30 **Recruitment:** Ensure technical profiles within the project team that could provide an added value for the specificity of the project, (e.g., interest in pedagogy for a school construction project). The best way to evaluate these interests is to recruit architects/engineers based on project portfolios that showcase their added value.

p. 50

31 **Trainings/workshops:** Organize design-oriented trainings/workshops at the beginning with project team members (Execution Unit and IDB), to align expectations and methodology, not only in terms of procedure but also in terms of project's vision and philosophy to strengthen project ownership and technical leadership. Repeat these trainings as necessary during the project implementation.

p. 50

32 **Presence on site:** Request the EU to ensure a weekly presence on site (weekly work inspection followed by meetings with construction firm, and supervision firm) to assess the progress of the works, to show its interest in the final product and to keep a good communication between all the parties.

p. 51

33 **Technical support from the IDB:** There should be a technical lead on the IDB's team to maintain a permanent dialogue with the technical members of the EU.

p. 51

34 **Capitalization on lessons learned:** Highlight relevant lessons learned documents in official project preparation documents such as POD.

p. 51

35 **Capitalization on lessons learned:** Adapt the Term of Reference of each project team member (at the EU and at the IDB) requesting them to evaluate strategies and methodologies in the light of the lessons learned.

p. 51

4. Up-scaling school construction countrywide

The new National school of Lamarque.
Photo: Alison Elias (IDB)

The wooden frame model for remote areas at the new National school of Tai-Fer (not implemented by the Program). Source: Swiss Cooperation (SDC)

Going local

This section presents some preliminary reflections towards a strategy to up-scale the construction of classrooms countrywide. These reflections were prepared by the IDB in September 2016 and presented to the sector in various workshops to open the discussion on the necessity to define a national policy for school construction, based on experiences and lessons learned[41].

The starting point of this exercise is the gap observed between construction needs and the actual construction pace, which was too slow, too costly, and too centralized to achieve the needs. These preliminary reflections explore the possibility to decentralize the project execution at the provincial/department level, and the opportunity to link school construction to the development of the local mid- and micro-economy, through the certification of Small and Medium Construction Enterprises (SMCEs) located in the provinces, for the execution of predefined non-complex construction works. A preliminary survey should be done to find local SMCEs throughout the country and to assess their capacities.

41 UBERTINI, Christian (2016 September). Preliminary reflections towards a policy to up-scale school construction in Haiti based on experiences and lessons learned. IDB working paper. Presented as: Les Mercredis de réflexion de la BID, 28 septembre 2016.

Limitations of the actual centralized approach

The Haitian Decanal Plan for Education 2017-2027 set the goal of rehabilitating and expanding 559 national schools deemed to be in fair condition (20% of the existing public schools) and reconstructing 950 national schools in very poor condition or operating under shelter (34% of the existing public schools). This plan would create 700,000 new seats, including 200,000 for preschool children. These figures represent the construction of approximately 13,245 classrooms[42] countrywide over the period of the plan.

It is estimated that the recent school construction programs, which started after the 2010 earthquake and were donor-funded and implemented by partners, resulted in about 2,000 classrooms being built in 10 years, equivalent to 20% of the plan's goals. At this speed, the actual needs would be filled by 2070.

42 2,795 classrooms as expansion of existing schools and 10,450 in new schools.

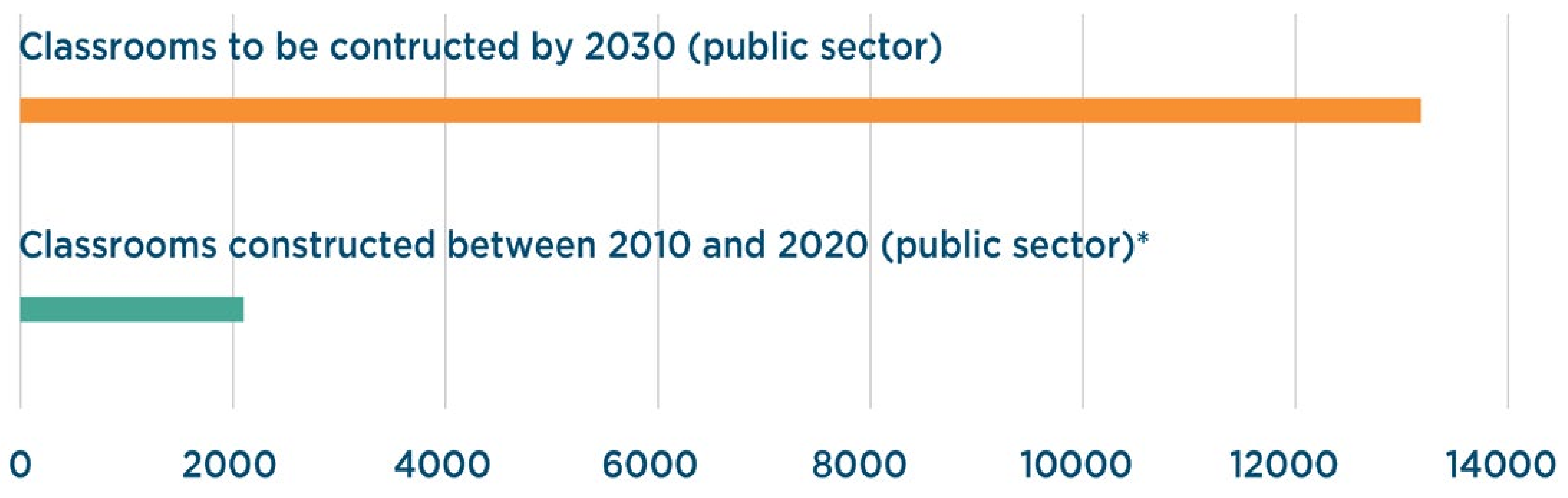


Table 24. Gap between needs and construction's pace. *IDB estimations (see Table 5).

This gap clearly shows the limitations of the actual strategy, characterized by a centralization of the project management, execution, and supervision, as well as the recruitment of large firms supposedly in a position to run numerous projects in parallel across the country. If this centralized approach proved to be adapted for complex projects located in urban or easily accessible areas, it appeared less effective when it came to construction of numerous schools dispersed throughout the country. This strategy excluded the local SMCEs in the provinces, which probably had more flexibility to execute the work but were unable to participate in bids because of their limited financial capacity. Among the 28 construction firms and 18 supervision firms recruited by the Program, only one was based in a department outside the Port-au-Prince metropolitan area. All the other firms were located around Port-au-Prince and far from the construction sites.

Up-scaling school construction countrywide can only be achieved through the decentralization of all or part of project's execution phases, and at least the execution and the supervision of works. To do so, the small and medium enterprises in the provinces must be at the center of the strategy.

Today, differentiated approaches are needed for up-scaling school construction, using centralization when size and project complexity require specific implementing capacities (new schools in urban or peri-urban areas, or multilevel buildings, etc.), and decentralization when it comes to expansion and up-grading of schools by addition of standard classrooms buildings based on single-level prototypes. The decentralization of project execution requires a new framework and new implementing mechanisms: reinforcement of the construction market in the provinces; active participation of municipalities and local communities; simplified bidding procedures (such as price comparison under the threshold and for simple works); and creation of a real coordination and supervision capacity at central level. These new implementing mechanisms should be part of a national strategy for school construction across the country.

Linking classroom construction to local mid- and micro-economy

Considering that Haiti has 10 administrative departments, the construction of 13,000 classrooms countrywide over a 10-year period, means an average construction pace of 130 classrooms per year and per department. This represents the construction of approximately 40 three-classroom buildings, like the confined masonry prototype (MC). Assuming a construction firm can build a minimum of five such buildings per year, eight firms per department working simultaneously would be needed to reach this construction pace.

The associated costs are less relevant to discuss here since we are focusing on the implementation strategy and not the funding mechanisms. However, to provide context, average construction costs per classroom under the actual centralized approach are around US$40,000, furniture and supervision costs included (see Table 12), thus the overall construction needs would represent a yearly investment per department of approximately US$5.2M over a 10-year period.

The expected construction pace means: 8 firms per department, each one constructing 5 buildings (MC-prototype) per year over a 10-years period.

Classroom construction could boost the local mid- and micro-economy and be an incentive for small construction firms to develop themselves.

In conclusion, the decentralized strategy assumes that each department has a roster of minimum eight local construction firms that can build five three-classroom buildings per year, over a 10-year period.

Local SMCEs at the center of the strategy

The construction of 13,000 classrooms countrywide over a 10-year period can only be achieved through the decentralization of all or part of the project's execution phases, and at least, the execution and the supervision phases. To do so, the small and medium firms located in the provinces must be at the center of the strategy. Focusing on local SMCEs means adapting implementation mechanisms to their financial and technical capacities and providing additional measures to compensate for their weaknesses.

The main strength of construction firms based in the province is the flexibility and the capacity to mobilize manpower at lower costs, compared to firms based in the capital. With an experienced engineer and foreman, they are technically able to execute any type of work using traditional masonry construction techniques. The single level confined masonry model (MC) has been designed especially for the scope to be executed by local SMCE's.

Putting local SMCEs at the center of the strategy means adapting the implementation mechanisms to their financial and technical capacities, and providing additional measures to compensate their weaknesses.

The weaknesses of the local SMCEs result from their limited financial capacity, compounded by the fact that they can hardly access bank credit or guarantees. These restrictions greatly impact their ability to compete and limit their development. However, local SMCEs exist and work on limited volumes and on limited contract amounts. Therefore, working with local SMCEs would fragment the infrastructure in smaller lots/phases to downsize contract amounts according to their financial capacities. For instance, a phase could correspond to a three-classroom building unit, for which a US$ 100,000 contract would be sufficient. This same contract could be then renewed for the next phases, and so on.

Another difficulty for local SMCEs is the purchase and the transport of expensive quality materials only available in the metropolitan area. Working with local SMCEs would also require the ability to support them with the purchase and supply of quality materials since the acquisition of such materials is easier for larger firms. An option would be to have separate supply firms, with greater capacities, to procure specific materials simultaneously to different sites.

Finally, local SMCEs are often not in position to complete complex bidding documents and would need training and simplified mechanisms to submit a technical and financial offer.

Local SMCEs can execute the work but need support to purchase and supply quality construction material. They need small contract amounts based on their financial capacities and practices, and simplified procurement processes. Local SMCEs would not handle design aspects and services.

Key points for the decentralized approach

Management and supervision by deconcentrated/decentralized structures

The decentralization of the execution also means the decentralization of the project management to decentralized/deconcentrated field structures. In Haiti, the model that can be taken as reference is the FAES EU, that has been originally organized to execute social programs in the regions with deconcentrated field offices. However, the existing deconcentrated structures of the MENFP in the provinces could be empowered to play a more central role.

The tasks of the field offices are the same as for any EU based in the capital, but with the advantage of being closer to the sites, allowing for direct supervision. These tasks are:

- Project preparation (evaluation, design)
- Procurement (selection of firm within the local register of certified firms)
- Contract management with local SMCEs, supplying firm, and supervisors
- Supervise directly or monitor the supervision of work
- Coordinating and organizing training activities
- Evaluation of the performance and maintaining the register of firm up to date

The advantage of having decentralization/deconcentrated structures for project management is that project execution can take place at different paces according to structure's capacity and specific context.

Definition and type of works

The decentralized approach is meant to execute non-complex and well-defined works, for which prototypes and full construction documents are already available. In Haiti, this would include:

- Construction of a three-classroom buildings of 150 square meters based on the single level confined masonry model (MC), including: foundations, walls, carpentry, roofing and gutters, installation of doors and windows, electrical wiring, plastering, and painting
- Construction of annexes (sanitary block, kitchen, reservoir) based on pre-validated models in confined masonry, including foundations, walls, carpentry, roofing and gutters, electrical wiring, plumbing, plastering, and painting
- Landscaping, fencing, paving, playground areas, arborization

Design aspects

Design aspects would be handled by the technical team in the field offices, strengthening supervision and project appropriation at the field level. In most of the cases, design needs would be limited to the development of the school master plan and to the adaptation of the foundations of the single level confined masonry prototype (MC) on a specific site. Where specific design capacities are needed, the design phase can be outsourced to an external consultant.

Training and certification of local SMCEs

The decentralized approach relies on the capacity of each department/region to create and maintain an up-to-date register of five to 10 local SMCEs habilitated to carry out the required type of work.

Firm registry can be done either through a standard Expression of Interest or through a certification process, accompanied by specific trainings and a mechanism to validate the learnings. In Haiti, specific training modules on confined masonry have been developed and are taught in various TVET centers across the country[43]. This training can be enlarged include administrative aspects. They can also become a requirement for the certification of local SMCEs joining the program.

43 For instance: 7 institutions in the West department, 3 in the South-East department, 5 in the South department, and 8 in the North department are proposing specific trainings on confined masonry. The complete list can be obtained at the "Institut National de Formation Professionnelle" INFP.

In Haiti, specific training modules on confined masonry works have been developed and are taught in various TVET centers across the country. This kind of training can be enlarged to administrative aspects. They can also become a requirement for the certification of local SMCE's joining the program.

The certification process should ensure that the SMCEs have the required technical and administrative capacities to:

- Formulate simplified technical and financial offers for the requested works
- Manage a financial contract of approximately US$100,000 (to be defined case by case)
- Purchase and supply basic construction material found on the local market (specific quality material found only in the capital such as metal bars, cement blocks, metal sheets, etc., should be purchased and supplied separately.

The National school of Zoranje.
Photo: Christian Ubertini (IDB)

The National school of Metayer
Photo: Natacha Dorelien (UTE)

- Mobilize the required resources and means to execute the works in fulfilment of the quality requirements
- Ensure the respect of the environmental and social safeguards on-site

To be certified, the SMCE should comply with the following criteria:

- Be registered and have a valid patent
- Have a physical address in the department concerned
- Have a bank account in the firm's name
- Have completed at least three similar construction projects in the last two years
- If applicable, have key staff members who have successfully completed the training modules

The minimal key staff should be as follows:

- One project manager (a civil engineer graduated from a recognized university, with a minimum of 10 years of experience)
- One supervisor of work (with a minimum 10 years of experience, and three similar constructions executed in the past three years)
- One social mobilizer also in charge of social and environmental safeguards
- One administrator/accountant
- One logistician for purchasing coordination

Central purchasing and supply of specific material

As explained above, specific quality construction material can only be purchased in Port-au-Prince. The purchase and the transport of those materials to the sites requires the means (functional trucks, etc.) and the financial resources that are often out of range for local SMCEs. This is one of the main reasons for the weak development of the construction industry in the provinces and rural areas. To work with local SMCEs implies finding a separate mechanism for the purchasing and supply of specific material to the different sites. This can be done by having separate contracts with centralized supply firms with greater capacities (this practice already exists in Haiti[44]).

The list of specific materials to be purchased by the supplying firms, needs to be defined after an assessment of the situation and in coordination with the local SMCEs.

44 This practice has been used by the firm which was awarded the construction of a TVET center financed by the IDB in Trou-du-Nord, in the northern part of the Island.

Generally, the materials found in Port-au-Prince are vibrated cement blocks, metal bars, wood or metal for the roof, and metal sheets for the roofing. Other materials (e.g., cement, rocks, gravel, and sand) are less difficult to find in the provinces and are also less expensive to be purchased by the local SMCEs.

Therefore, for the construction of three-classroom buildings, the logistics should include two to four different transports at different stages of the construction: one or two transports at the beginning for the cement blocks and the metal bars; one or two transports at the mid-stage for the roofing materials and other equipment if applicable (windows, etc.).

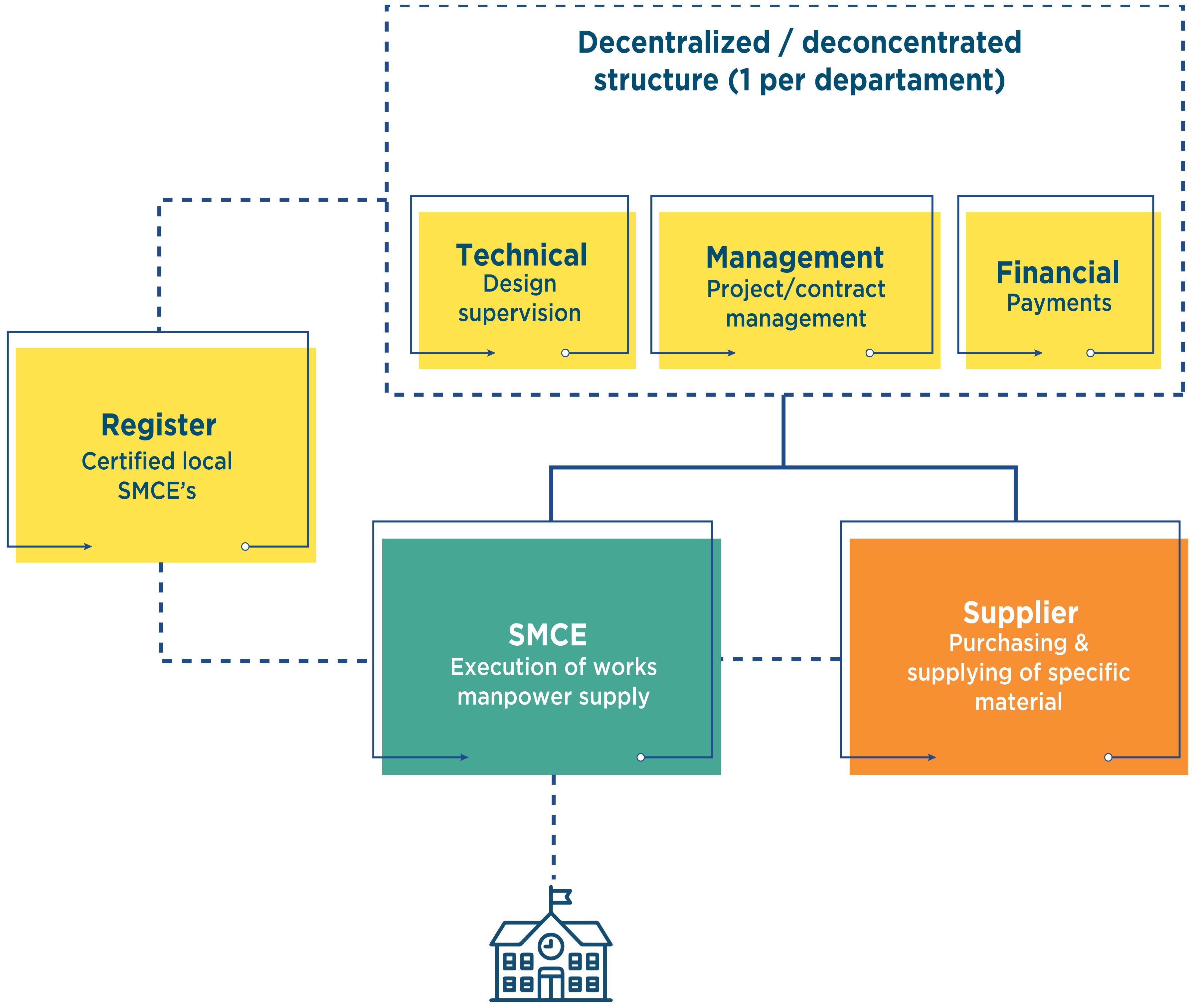


Table 25. Proposed set-up for the decentralized approach around local SMCEs.

This option has advantages for a large-scale multiple construction project:

- **Combines the strength of both actors:** the local SMCEs for its flexibility to execute the works; the large construction firm for its capacity to purchase and supply the material
- **Fits the financial capacity of both actors:** Several small contracts for the local SMCEs (work only, without the costly purchase of quality material); few larger contracts for the central supply firms
- **Reduces the costs through economies of scale:** The quantity of material will also lead to real economy for scales for the supplying firm, which are not possible to do when the construction firm needs to do all, purchase, supply, and construction
- **Controls the costs over the project period:** The contracts with the supplying firm can be negotiated with fixed prices for a certain period

The risks associated with this practice are mainly: a) coordination between the different SMCEs and the supply firm, and b) the fact that any malperformance of the supply firm will affect the progress in various sites. The first risk is mitigated by the fact that the logistics challenge is handled by the supply firm. The second risk would be mitigated by a careful selection of the supply firm. Overall, the risk is not greater than that for a firm awarded with a large-batch contract of 10 schools.

Adapting procurement modalities

IDB's procurement policies allow national bidding processes (depending on threshold) that foster participation of local firms and suppliers and promote the use of simplified methods such as price comparison for certain amounts and complexity levels. We will not detail here the procurement modalities as they need to be defined and fine-tuned according to the capacity of the local SMCEs. In any case, an evaluation of capacity of local firms/suppliers as well as decentralized/local government bodies must be conducted to assess the feasibility of the proposed strategy.

Direct supervision by deconcentrated/decentralized structures.

The presence of field offices near the construction sites allows for direct supervision, which offers several advantages for such repetitive and non-complex type of work. These are:

- Reinforcing the appropriation of the project by the project management team
- Reducing the number of intermediaries between the SMCEs and the project management structure
- Speeding up payments to the firms
- Anticipating and addressing problems quickly

In-house supervision by the field offices requires a specific set-up with a dedicated supervision team that can visit the sites every day. Given the nature of the work and the fact that the SMCEs are familiar with the model to be constructed, supervision will mainly consist in monitoring the progress, controlling the quality, and issuing progress report for payments to the firms.

Payment mechanisms

The timely payment to a firm is essential for any construction work but it is even more crucial for the local SMCEs as they are more likely to be affected by an interruption of cash flow. The precise sequence of payments must be discussed with the SMCEs, but generally, given the small amount of the contract (approximately US$100,000) and the repetitive character of the work, the payments (for lump sum contracts) could be made according to pre-defined progress stages such as:

- 30% as advance payment, and for construction of foundations and walls[45]
- 30% after completion of elevations, for the roofing
- 30% after completion of the roofing, for the finishing work
- 10% on final acceptance of the work

The process to approve a payment must be quick and efficient. Once the redefined stage of construction is verified by the supervisor, the payment should not take more than two weeks to reach the firm's bank account. For that, the decentralized/deconcentrates structures must be in position to issue the payments without an additional verification at the central level.

Pilot phase

This new approach was intended to be tested as a pilot phase in a possible future project in Haiti. This would require a specific preparation phase to set up the decentralized/deconcentrated structure and implement few pilot constructions, to verify and adapt the feasibility of this approach.

45 Any advance payment must be guaranteed, which is a good practice and is the Bank's policy. The local SMCEs will need to obtain the guarantees. There could a need of discussion with the local credit unions to make sure they can be provided, with eventually the constitution of a special guarantee fund.

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5. Annexes

Interior of a classroom at the new National school of Argentine Bellegarde. Photo: Alison Elias (IDB)

Annex 1

List of school built under the four operations financed by the Program

I	HA-L1049 – ARSE I/19 (17 schools)				
	Ecole nationale (EN)	***Department***	***Localization***	***Model***	***Agency***
1	EN Babpanyol	Nord-Ouest	19.81785, -73.08567	Ad-hoc	FAES
2	EN Barrière Blanche	Nord	19.69092, -72.32125	Ad-hoc	FAES
3	EN Cana	Nord-Est	19.48037, -71.70047	MC	FAES
4	EN Chansolme	Nord-Ouest	19.88322, -72.8343	Ad-hoc	FAES
5	EN Dos Palais	Centre	18.8313, -71.84454	Ad-hoc	FAES
6	EN Duclos	Artibonite	19.42408, -72.27928	MC	FAES
7	EN Dufanal	Sud	18.27522, -74.16425	Ad-hoc	FAES
8	EN Filles de Fort Liberté	Nord-Est	19.65085, -71.83006	MC	FAES
9	EN Furcy	Ouest	18.42283, -72.29614	Ad-hoc	FAES
10	EN Garde Farge	Nord	19.78052, -72.38021	Ad-hoc	FAES
11	EN Léon	Grand' Anse	18.54574, -74.11278	Ad-hoc	FAES
12	EN Mapou	Nord-Ouest	19.73343, -73.18699	Ad-hoc	FAES
13	EN Mixte d'Aquin	Sud	18.28047, -73.3982	Ad-hoc	FAES
14	EN Mixte de Plaisance	Nord	19.59843, -72.48017	Ad-hoc	FAES
15	EN Moron	Grand' Anse	18.56477, -74.25194	BA	FAES
16	EN Sarazin	Centre	18.79543, -72.00211	MC	FAES
17	EN Vallières	Nord-Est	19.43372, -71.9203	MC	FAES

II	HA-L1049 – ARSE II (29 schools)				
	Ecole nationale (EN)	***Department***	***Localization***	***Model***	***Agency***
18	EN Argentine Bellegarde	Ouest	18.54029, -72.32317	BA	FAES
19	EN Belle Mer de Pignon	Nord	19.29218, -72.13133	MC	FAES
20	EN Block-Hauss	Sud-Est	18.21059, -72.89803	MC	FAES
21	EN Bois de Laurence	Nord-Est	19.33002, -71.86737	MC	FAES
22	EN Cholette	Nippes	18.44114, -73.21483	MC	FAES
23	EN Damé	Nord-Ouest	19.76058, -73.24838	MC	FAES
24	EN Degand	Ouest	18.51001, -72.43653	MC	FAES
25	EN Délices	Artibonite	18.86588, -72.4213	MC	FAES
26	EN Dubuisson	Ouest	18.73801, -72.43706	MC	FAES
27	EN Duparc	Nippes	18.39562, -73.09785	MC	FAES
28	EN Elie Dubois	Ouest	18.54594, -72.3424	Ad-hoc	FAES
29	EN Grand Bassin	Nord-Est	19.58677, -71.93991	MC	FAES
30	EN Grand Vincent	Grand' Anse	18.55813, -74.06999	Ad-hoc	FAES
31	EN Grande Hatte	Artibonite	19.1467, -72.42788	MC	FAES
32	EN Imm. de Conception	Sud	18.32584, -73.86692	Ad-hoc	FAES
33	EN Jonc	Ouest	18.52799, -72.16343	MC	FAES
34	EN Labiche	Sud-Est	18.20219, -72.94723	MC	FAES
35	EN Lacroix	Sud-Est	18.2149, -72.62459	MC	FAES
36	EN Lafleur	Nord-Est	19.54658, -71.81469	MC	FAES
37	EN Laguamithe	Nord-Est	19.30628, -71.89046	MC	FAES
38	EN Lamarque/Frossard	Nippes	18.44647, -73.57016	MC	FAES
39	EN Mayette	Sud-Est	18.16873, -72.93346	MC	FAES
40	EN Pascal	Nippes	18.42166, -73.51643	Ad-hoc	FAES
41	EN Pichon	Sud-Est	18.2623, -71.99727	MC	FAES
42	EN Pointe Des Mangles	Artibonite	19.56897, -72.93219	MC	FAES
43	EN Ravine Trompette	Nord	19.67871, -72.5806	MC	FAES
44	EN Sans-Souci	Nord	19.61247, -72.20307	MC	FAES
45	EN Soulé	Grand' Anse	18.49044, -74.42811	Ad-hoc	FAES
46	EN Torbeck	Sud	18.16098, -73.82271	Ad-hoc	FAES

III	HA-L1060 – AMOPERE (24 schools)				
	Ecole nationale (EN)	***Department***	***Localization***	***Model***	***Agency***
47	EN Biassou	Centre	19.14438, -71.73562	MC	FAES/FCA
48	EN Bossard	Nippes	18.48012, -73.35595	Ad-hoc	FAES
49	EN Caduc	Sud-Est	18.25419, -72.0467	Ad-hoc	FAES
50	EN Calumette	Sud-Est	18.26552, -72.12759	Ad-hoc	FAES
51	EN Carénnages	Nippes	18.47291, -73.34843	Ad-hoc	FAES
52	EN Cité Lumière	Sud-Est	18.23364, -72.5551	Ad-hoc	FAES
53	EN Colin de Jacmel	Sud-Est	18.2261, -72.60065	Ad-hoc	FAES
54	EN Colin de Thiotte	Sud-Est	18.24558, -71.81877	Ad-hoc	FAES
55	EN Externat La Providence	Ouest	18.54869, -72.34116	Ad-hoc	FAES
56	EN Jean Dumas	Ouest	18.82856, -72.46159	MC	FAES
57	EN Lafond	Sud-Est	18.28033, -72.52004	Ad-hoc	FAES
58	EN Layaille	Centre	18.95198, -71.82966	MC	FAES/FCA
59	EN Le Phare	Ouest	18.7697, -72.46385	MC	FAES
60	EN Mahot	Sud-Est	18.24038, -71.88897	Ad-hoc	FAES
61	EN Marbre	Centre	19.18913, -71.83393	MC	FAES
62	EN Mare Sucrin	Ouest	18.78648, -72.94525	MC	FAES
63	EN Masson	Nippes	18.39817, -73.16201	Ad-hoc	FAES
64	EN Nan Citron	Centre	19.11207, -71.99899	MC	FAES/FCA
65	EN Pacasse	Centre	19.10113, -71.72564	MC	FAES/FCA
66	EN Platon Figuier	Sud-Est	18.26322, -71.86586	Ad-hoc	FAES
67	EN Pointe à Raquette	Ouest	18.78799, -73.0631	MC	FAES
68	EN Savanne Salee	Artibonite	19.27803, -72.65804	MC	FAES/FCA
69	EN Zabot	Sud-Est	18.17776, -72.91702	Ad-hoc	FAES
70	EN Zorange	Ouest	18.63000, -72.32027	Ad-hoc	FAES

III	HA-L1077 – ACEQH (18 schools)				
	Ecole nationale (EN)	***Department***	***Localization***	***Model***	***Agency***
71	EN Bas Flon	Ouest	18.53982, -72.568	MC-BA	UTE
72	EN Canot	Centre	18.87378, -71.89212	MC	UTE
73	EN Chaudery	Sud-Est	18.31861, -72.1797	MC	UTE
74	EN Debute	Centre	18.7655, -72.06994	MC	UTE
75	EN d'Herbe a Fleche	Nord-Ouest	19.87493, -73.11222	MC	UTE
76	EN Guatemala	Ouest	18.5164, -72.29084	BA	UTE
77	EN Haut Baie d'Orange	Sud-Est	18.30047, -72.22023	MC	UTE
78	EN Haut Ravine Normande	Sud-Est	18.25404, -72.44025	MC	UTE
79	EN Mare-Rouge	Nord-Ouest	20.03191, -72.78679	MC	UTE
80	EN Maurice David	Ouest	18.41913, -72.93415	MC	UTE
81	EN Metayer	Nord-Ouest	19.80688, -73.23094	MC	UTE
82	EN Montrouis	Ouest	18.94498, -72.69391	MC	UTE
83	EN Montry	Nord-Ouest	20.04192, -72.83288	MC	UTE
84	EN Passe Catabois	Nord-Ouest	19.82731, -72.94068	MC	UTE
85	EN Pelissier	Nord-Ouest	19.70806, -73.34989	MC	UTE
86	EN Ramadou	Nord-Ouest	19.84476, -73.26651	MC	UTE
87	EN Thor	Ouest	18.53332, -72.38943	BA	UTE
88	EN Village Espérance	Centre	18.82128, -72.1134	MC	UTE

IV	HA-L1080 – APREH (2 schools)				
	Ecole nationale (EN)	***Department***	***Localization***	***Model***	***Agency***
89-90	EN de Cabaret*	Ouest	18.73391, -72.41984	BA	UTE
90	EN Descloches	Ouest	18.56557, -72.14717	MC	UTE
	* Double school (double capacity)				

Annex 2

Project data sheet of selected schools

National School of Chansolme

DC + S, small batch, ad-hoc plans, peri-urban area

Project	
Operation	HA-L1049 (ARSE 19)
Location	Port-de-Paix, Northwest
GPS Coordinates	19.88322, -72.8343
Executing Agency	Fond d'Assistance Economique et Sociale (FAES)
Completion date	2018
Constructed area	1,250 m2
Number of Classrooms	11
Number of seats	410
Contract	
Project delivery method	DC + S (Design & Construction + Supervision)
Nb of school per contract	1
Implementation context	Peri-urban area
Model / plans	Ad hoc plans, 2-levels
Costs* in US$	
Date of tender	2011
Project design	-
Construction	615,352
Supervision	42,523
Total	**657,875**
Construction costs/m2	492
Cost per classroom	59,806
Cost per seat	1,604

* Approximative costs based on initial contracts converted from HTG in US$ and calculated as an average when contracts include multiple projects.

National School of Furcy

DC + S, small batch, ad-hoc plans, rural area

Project	
Operation	HA-L1049 (ARSE 19)
Location	Furcy, West
GPS Coordinates	18.42283, -72.29614
Executing Agency	Fond d'Assistance Economique et Sociale (FAES)
Completion date	2016
Constructed area	1,350 m2
Number of Classrooms	11
Number of seats	410
Contract	
Project delivery method	DC + S (Design & Construction + Supervision)
Nb of school per contract	1
Implementation context	Rural area
Model / plans	Ad hoc plans, single level
Costs* in US$	
Date of tender	2011
Project design	-
Construction	1,305,743
Supervision	90,113
Total	**1,395,856**
Construction costs/m2	967
Cost per classroom	126,896
Cost per seat	3,316

* Approximative costs based on initial contracts converted from HTG in US$ and calculated as an average when contracts include multiple projects.

National School of Lafleur

DC + S, large batch, prototype single level (MC), rural area

Project	
Operation	HA-L1049 (ARSE)
Location	Ouanaminthe, Northeast
GPS Coordinates	19.54658, -71.81469
Executing Agency	Fond d'Assistance Economique et Sociale (FAES)
Completion date	2016
Constructed area	1,370 m2
Number of Classrooms	11
Number of seats	410
Contract	
Project delivery method	DC + S (Design & Construction + Supervision)
Nb of school per contract	10
Implementation context	Rural area
Model / plans	Prototype MC, single level
Costs* in US$	
Date of tender	2013
Project design	-
Construction	987,241
Supervision	43,180 (average)
Total	**1,030,421**
Construction costs/m2	721
Cost per classroom	93,675
Cost per seat	2,513

* Approximative costs based on initial contracts converted from HTG in US$ and calculated as an average when contracts include multiple projects.

National School of Lamarque

DC + S, small batch, prototype single level (MC), rural area

Project	
Operation	HA-L1049 (ARSE)
Location	Plaisance, Nippes
GPS Coordinates	18.44647, -73.57016
Executing Agency	Fond d'Assistance Economique et Sociale (FAES)
Completion date	2017
Constructed area	875
Number of Classrooms	8
Number of seats	290
Contract	
Project delivery method	DC + S (Design & Construction + Supervision)
Nb of school per contract	5
Implementation context	Rural area
Model / plans	Prototype MC, single level
Costs* in US$	
Date of tender	2014
Project design	-
Construction	539,968
Supervision	52,500 (average)
Total	**592,468**
Construction costs/m2	617
Cost per classroom	74,058
Cost per seat	2,042

* Approximative costs based on initial contracts converted from HTG in US$ and calculated as an average when contracts include multiple projects.

National School of Zabot

DC + S, large batch, ad-hoc plans, rural area

Project	
Operation	HA-L1060 (AMOPERE)
Location	Côte-de-Fer, Southeast
GPS Coordinates	18.17776, -72.91702
Executing Agency	Fond d'Assistance Economique et Sociale (FAES)
Completion date	2016
Constructed area	1,250 m2
Number of Classrooms	11
Number of seats	410
Contract	
Project delivery method	DC + S (Design & Construction + Supervision)
Nb of school per contract	10
Implementation context	Rural area
Model / plans	Ad-hoc plans, single level
Costs* in US$	
Date of tender	2013
Project design	-
Construction	648,229
Supervision	62,021
Total	**710,250**
Construction costs/m2	518
Cost per classroom	64,568
Cost per seat	1,732

* Approximative costs based on initial contracts converted from HTG in US$ and calculated as an average when contracts include multiple projects.

National School of Zoranje

DC + S, large batch, ad-hoc plans, prefabricated system, semi-urban area

Project	
Operation	HA-L1060 (AMOPERE)
Location	Croix des Bouquets, West
GPS Coordinates	18.63000, -72.32027
Executing Agency	Fond d'Assistance Economique et Sociale (FAES)
Completion date	2016
Constructed area	1,370 m2
Number of Classrooms	11
Number of seats	410
Contract	
Project delivery method	DC + S (Design & Construction + Supervision)
Nb of school per contract	10
Implementation context	Rural area
Model / plans	Ad-hoc plans, single level, light gauge steel prefabricated system
Costs* in US$	
Date of tender	2013
Project design	-
Construction	1,180,345
Supervision	64,953
Total	**1,245,298**
Construction costs/m2	861
Cost per classroom	113,108
Cost per seat	3,037

* Approximative costs based on initial contracts converted from HTG in US$ and calculated as an average when contracts include multiple projects.

National School of Guatemala

DC + S, large batch, prototype multi-level (BA), urban area

Project	
Operation	HA-L1077 (ACEQH)
Location	Pétion-Ville, West
GPS Coordinates	
Executing Agency	Unité Technique d'Exécution (UTE)
Completion date	2019
Constructed area	1,585 m2 (including 670 m2 rehabilitation of existing building)
Number of Classrooms	18 (including rehabilitation of 9 existing classrooms)
Number of seats	720
Contract	
Project delivery method	DC + S (Design & Construction + Supervision)
Nb of school per contract	10
Implementation context	Urban area
Model / plans	Prototype BA, 3-levels
Costs* in US$	
Date of tender	2014
Project design	-
Construction	970,093
Supervision	69,781 (average)
Total	**1,039,874**
Construction costs/m2	N/A
Cost per classroom	57,770
Cost per seat	1,444

* Approximative costs based on initial contracts converted from HTG in US$ and calculated as an average when contracts include multiple projects.

National School of Passe Catabois

DC + S, large batch, prototype single level (MC), rural area

Project	
Operation	HA-L1077 (ACEQH)
Location	Port-de-Paix, Northwest
GPS Coordinates	19.82731, -72.94068
Executing Agency	Unité Technique d'Exécution (UTE)
Completion date	2019
Constructed area	1,410 m2
Number of Classrooms	11
Number of seats	410
Contract	
Project delivery method	DC + S (Design & Construction + Supervision)
Nb of school per contract	10
Implementation context	Rural area
Model / plans	Prototype MC, single level
Costs* in US$	
Date of tender	2015
Project design	-
Construction	824,031 (average)
Supervision	81,445 (average)
Total	**905,476**
Construction costs/m2	584
Cost per classroom	82,316
Cost per seat	2,208

* Approximative costs based on initial contracts converted from HTG in US$ and calculated as an average when contracts include multiple projects.

National School of Cabaret

D + C + S, small batch, prototype multi-level (BA), urban area

Project	
Operation	HA-L1080 (APREH)
Location	Cabaret, West
GPS Coordinates	18.73391, -72.41984
Executing Agency	Unité Technique d’Exécution (UTE)
Completion date	2018
Constructed area	2,635 m2
Number of Classrooms	22
Number of seats	820
Contract	
Project delivery method	D + C + S (Design + Construction + Supervision)
Nb of school per contract	1
Implementation context	Urban area
Model / plans	Prototype BA, 2-levels
Costs* in US$	
Date of tender	2017
Project design	30,000 (average)
Construction	1,276,000
Supervision	140,000 (average)
Total	**1,446,000**
Construction costs/m2	448
Cost per classroom	65,727
Cost per seat	1,763

* Approximative costs based on initial contracts converted from HTG in US$ and calculated as an average when contracts include multiple projects.

National School of Descloches

D + C + S, small batch, prototype single level (MC), rural area

Project	
Operation	HA-L1080 (APREH)
Location	Ganthier, West
GPS Coordinates	18.56557, -72.14717
Executing Agency	Unité Technique d'Exécution (UTE)
Completion date	2016
Constructed area	1,410 m2
Number of Classrooms	11
Number of seats	410
Contract	
Project delivery method	D + C + S (Design + Construction + Supervision)
Nb of school per contract	1
Implementation context	Rural area
Model / plans	Prototype MC, single level
Costs* in US$	
Date of tender	2017
Project design	30,000 (average)
Construction	777,821
Supervision	70,000 (average)
Total	**877,821**
Construction costs/m2	551
Cost per classroom	79,802
Cost per seat	2,141

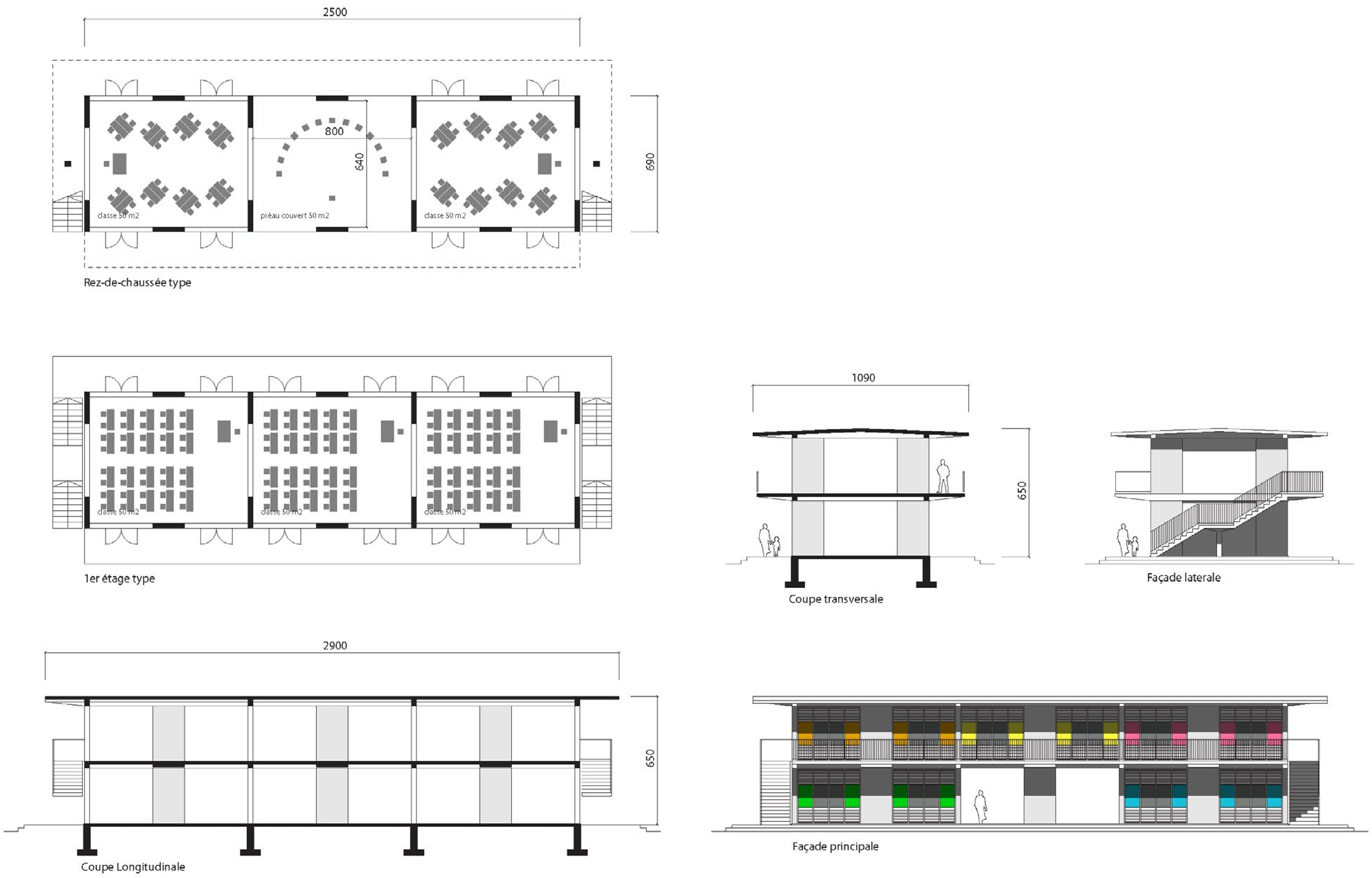
* Approximative costs based on initial contracts converted from HTG in US$ and calculated as an average when contracts include multiple projects.

Annex 3

Prototypes

(illustration by C. Ubertini)

Minsitère de l'Education Nationale et de la Formation Professionnelle MENFP Plany-types pour écoles fondamentales **BA-6x50** Modèle urbain standard en béton armé sur 2 niveaux	Utilisation: Espaces : 6 classes de 50 m2 Capacité : 240 places-élèves (40/cl.) Utilisation : classes, administration, bibliothèques, salles spéciales	Conditions / recommandations : Zones: urbain et périurbain Accès : route et camion lourd Maîtrise d'ouvrage : centralisée Exécution : firmes spécialisées	Construction: Structure : béton armée brut Toiture : béton armée brut Parois intérieurs : bois ou panneau Portes-fenêtres : métallique grillagé	Surfaces: Surface brut : 463 m2 Surface utile : 300 m2 Surface au sol : 195 m2 Surface toiture : 316 m2



Minsitère de l'Education Nationale et de la Formation Professionnelle MENFP
Plany-types pour écoles fondamentales

BA-9x50

Modèle urbain dense
en béton armé sur 3 niveaux

Utilisation:

Espaces : 9 classes de 50 m2
Capacité : 360 places-élèves (40/cl.)
Utilisation : classes, administration bibliothèques, salles spéciales

Conditions / recommandations :

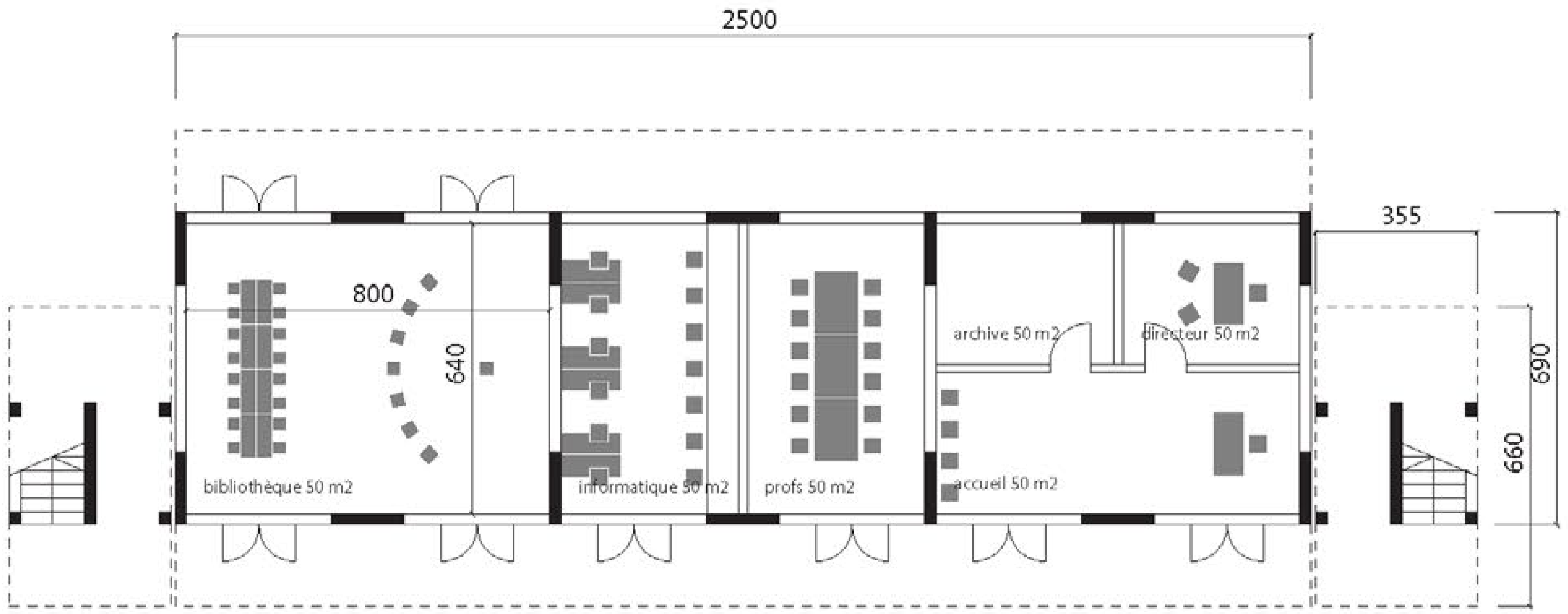
Zones : urbain et périurbain
Accès : route et camion lourd
Maîtrise d'ouvrage : centralisée
Exécution : firmes pécialisées

Construction:

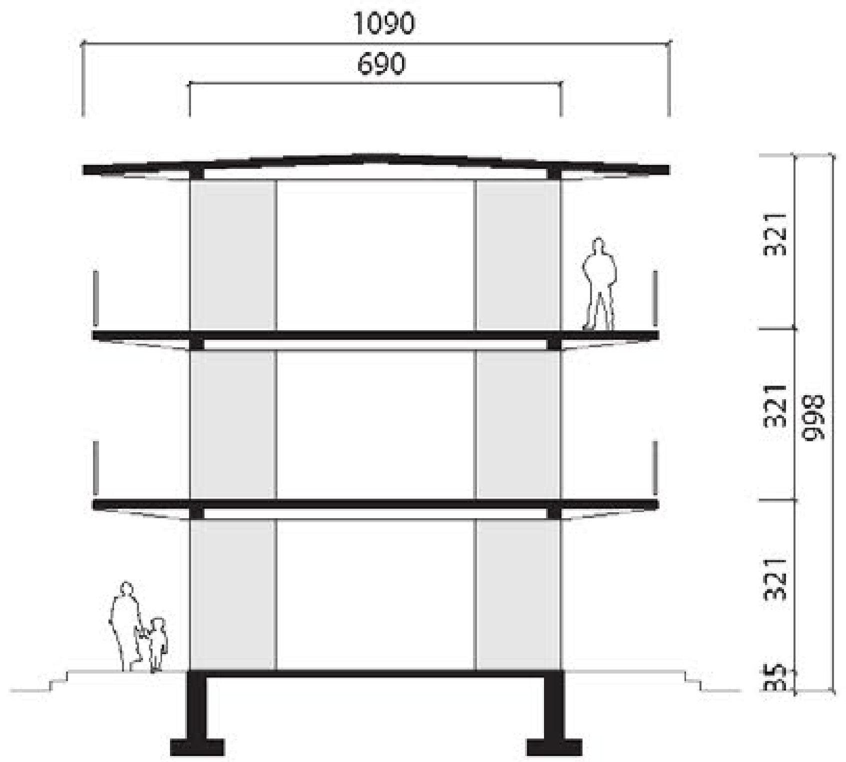
Structure : béton armée brut
Toiture : béton armée brut
Parois intérieurs : bois ou panneau
Portes-fenêtres : métallique grillagé

Surfaces:

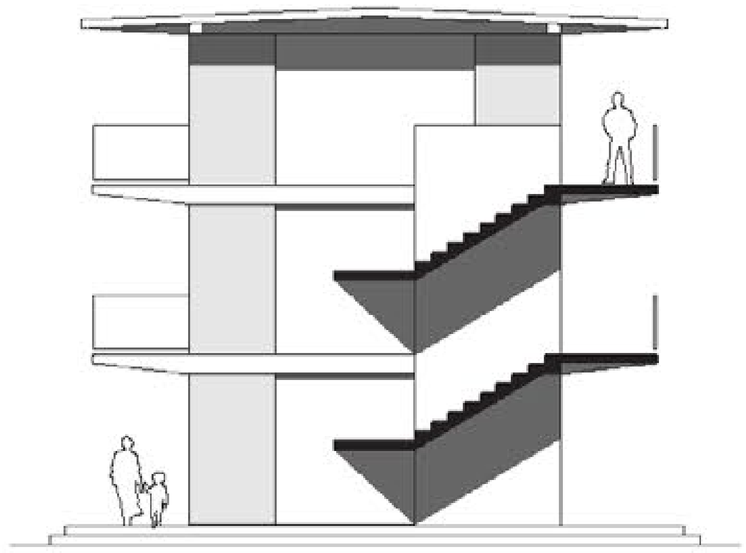
Surface brut : 775 m2
Surface utile : 450 m2
Surface au sol : 207 m2
Surface toiture : 316 m2

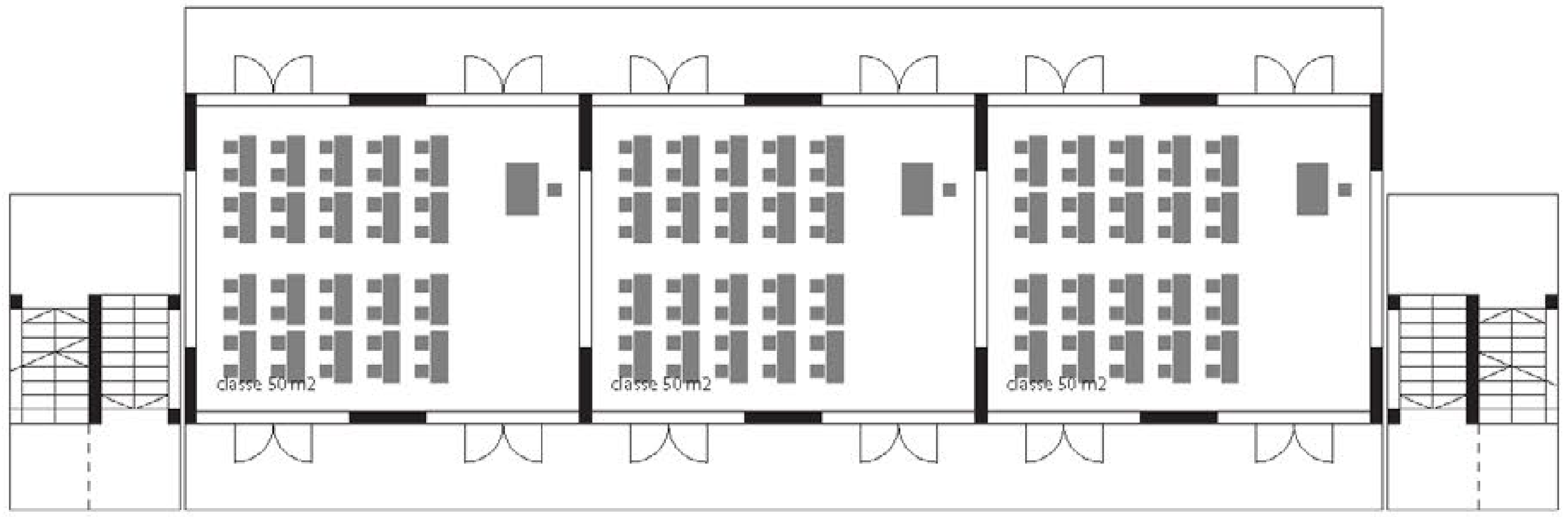


Rez-de-chaussée type

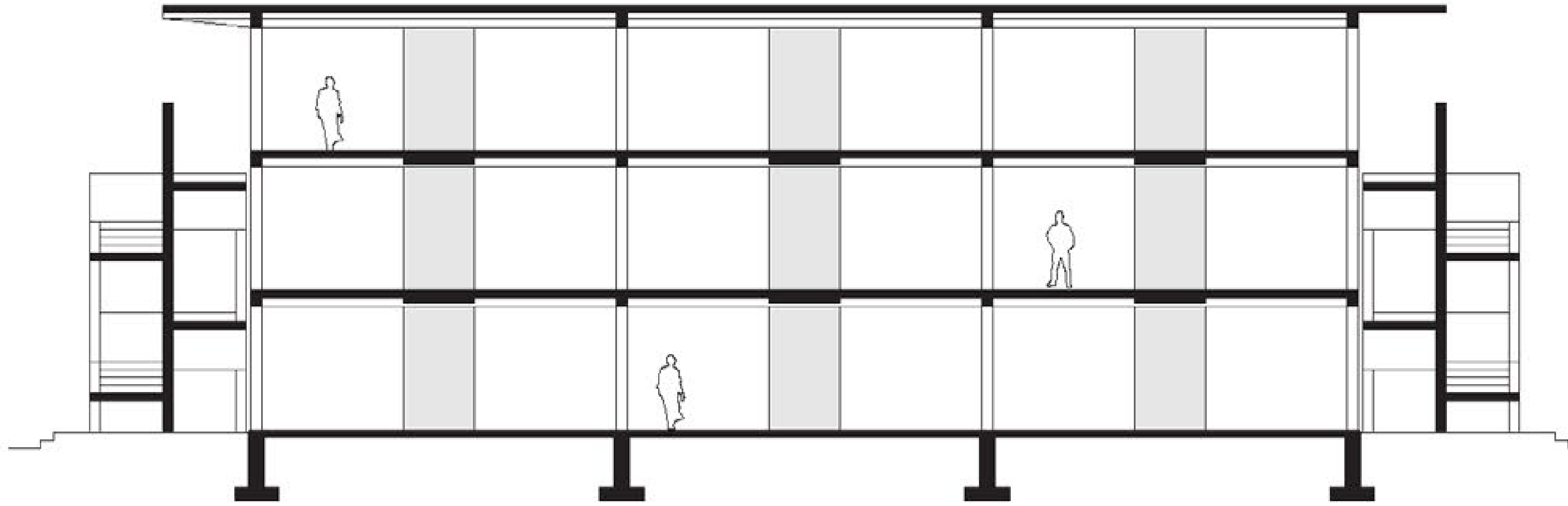


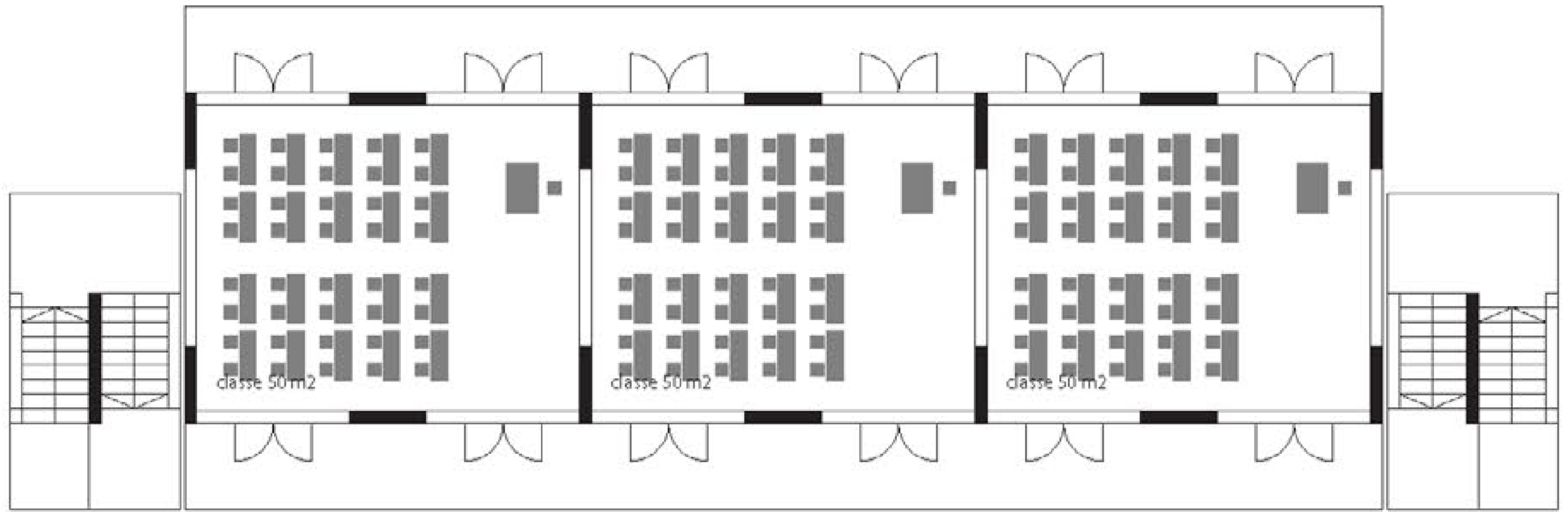
Coupe transversale


Façade latérale

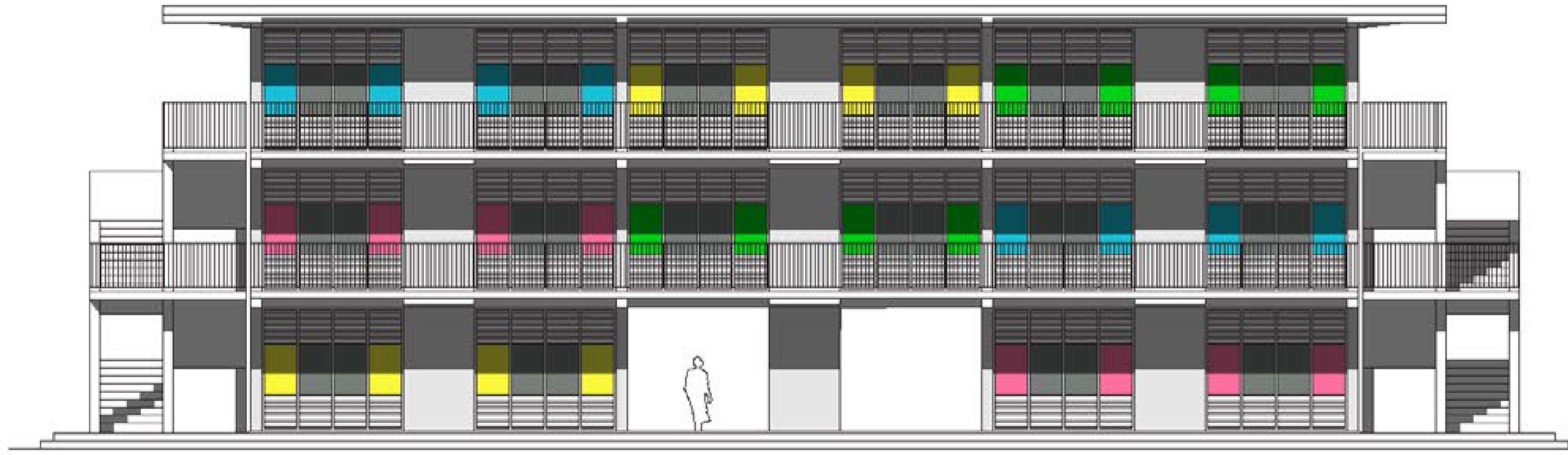


1er étage type


Coupe Longitudinale



2ème étage type


Façade principale

Minsitère de l'Education Nationale et de la Formation Professionnelle MENFP
Plany-types pour écoles fondamentales

BA-4x75

Modèle urbain grandes salles en béton armé sur 2 niveaux

Utilisation:

Espaces : 4 classes de 75 m2
Capacité : 240 places-élèves (60/cl.)
Utilisation : classes, administration bibliothèques, salles spéciales

Conditions / recommandations :

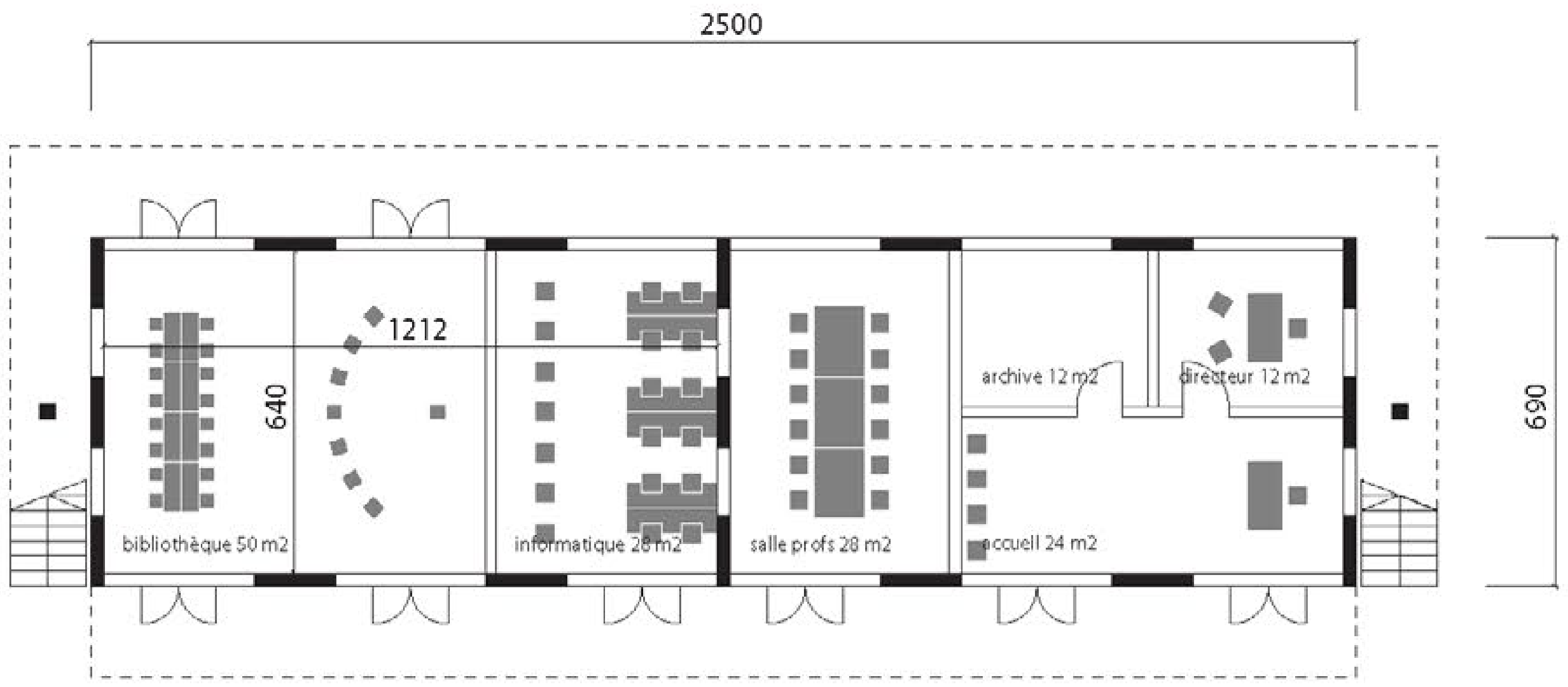
Zones : urbain et périurbain
Accès : route et camion lourd
Maîtrise d'ouvrage : centralisée
Exécution : firmes spécialisées

Construction:

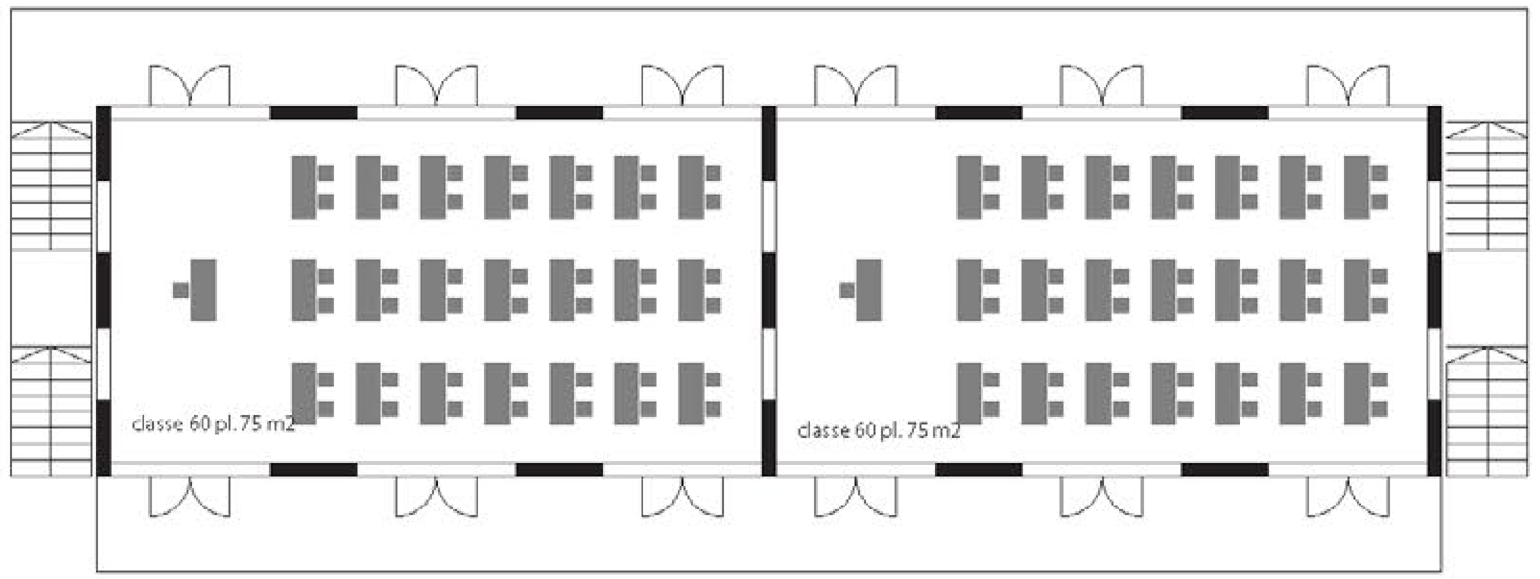
Structure : béton armée brut
Toiture : béton armée brut
Parois intérieurs : bois ou panneau
Portes-fenêtres : métallique grillagé

Surfaces:

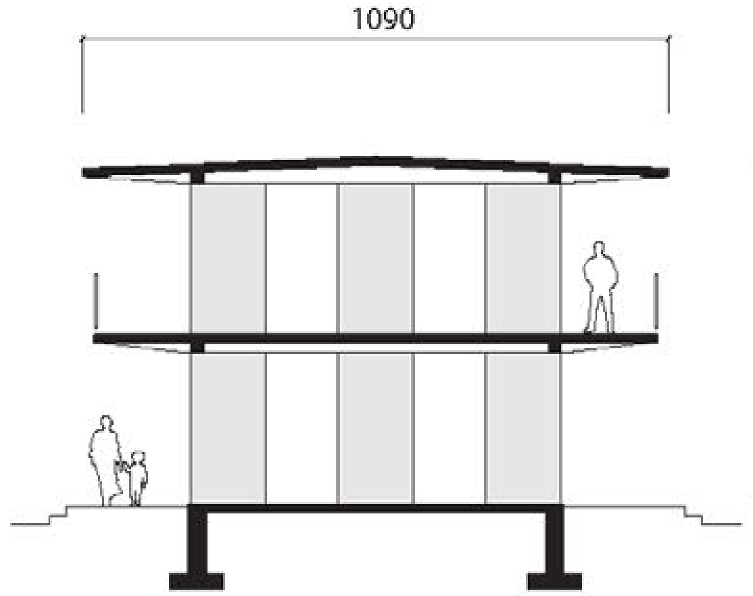
Surface brut : 463 m2
Surface utile : 300 m2
Surface au sol : 195 m2
Surface toiture : 316 m2



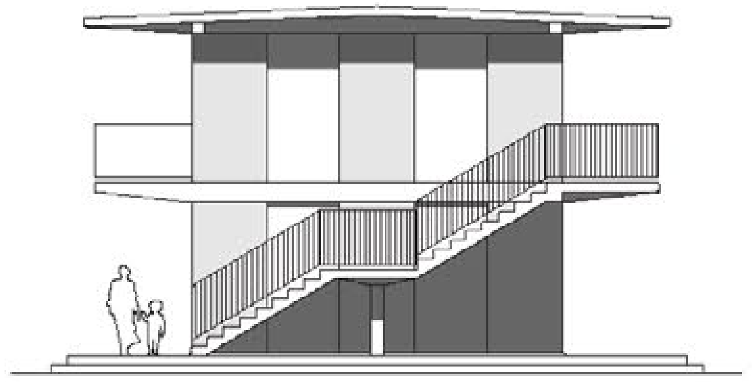
Rez-de-chaussée type

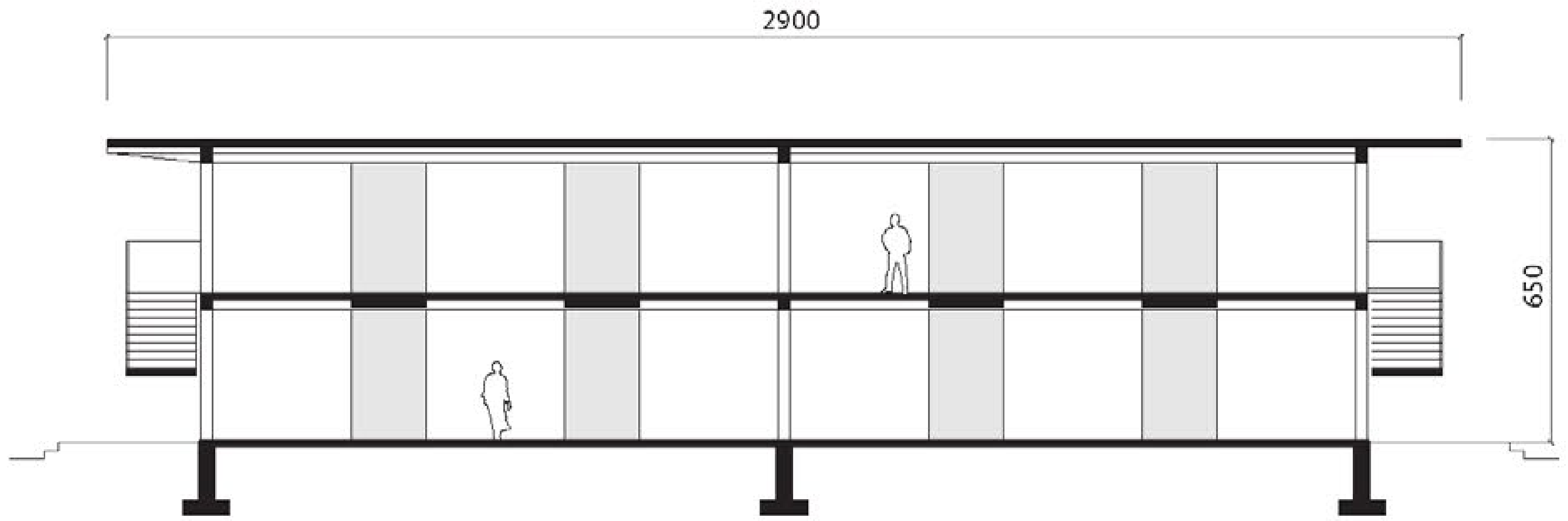


1er étage type



Coupe transversale


Façade laterale



Coupe Longitudinale


Façade principale

Minsitère de l'Education Nationale et de la Formation Professionnelle MENFP
Plany-types pour écoles fondamentales

BA-2x100

Modèle urbain multifonction en béton armé sur 2 niveaux

Utilisation:

Espaces : 6 x 100 m2 + 4 x 25 m2
Capacité : env.250 places
Utilisation : salle multifonction, cuisine, réfectoire, salles spéciales, etc.

Conditions / recommandations :

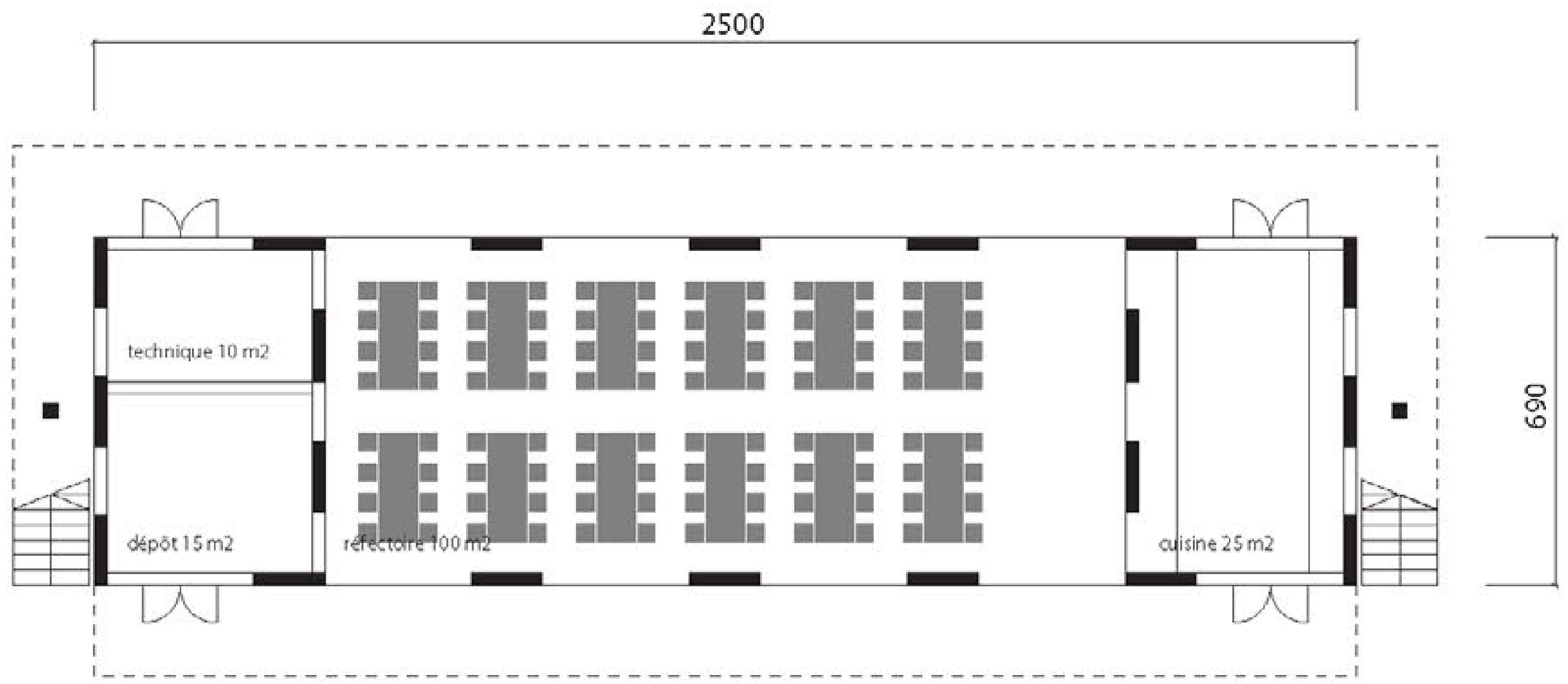
Zones : urbain et périurbain
Accès : route et camion lourd
Maîtrise d'ouvrage : centralisée
Exécution : firmes spécialisées

Construction:

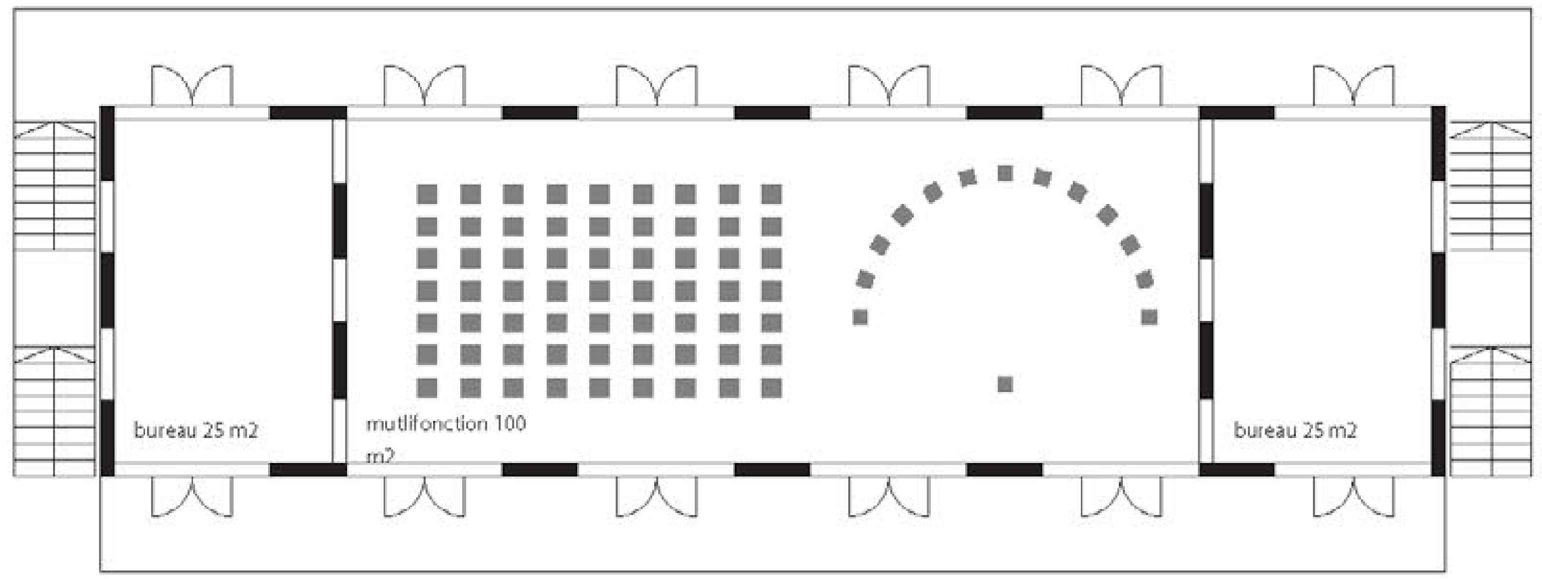
Structure : béton armée brut
Toiture : béton armée brut
Parois intérieurs : bois ou panneau
Portes-fenêtres : métallique grillagé

Surfaces:

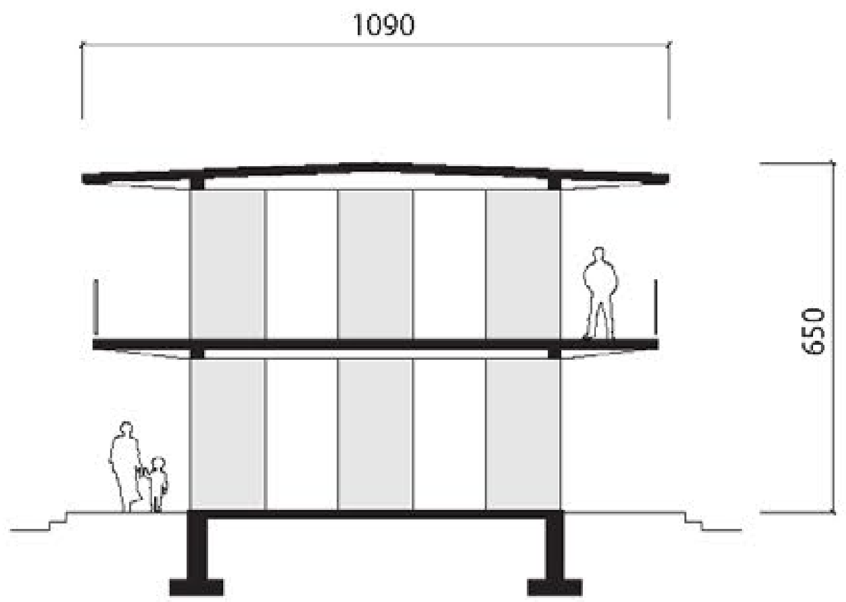
Surface brut : 463 m2
Surface utile : 300 m2
Surface au sol : 195 m2
Surface toiture : 316 m2



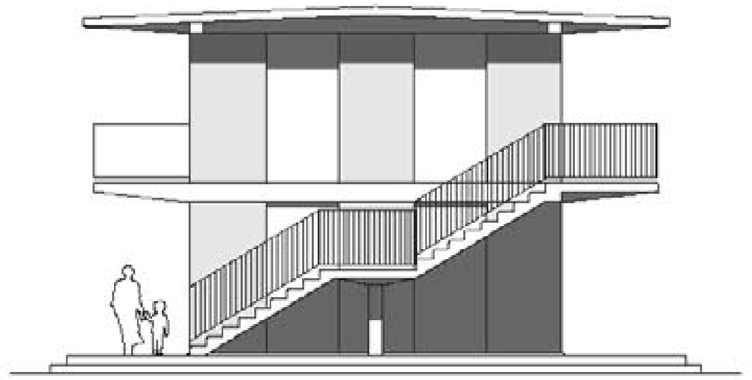
Rez-de-chaussée type

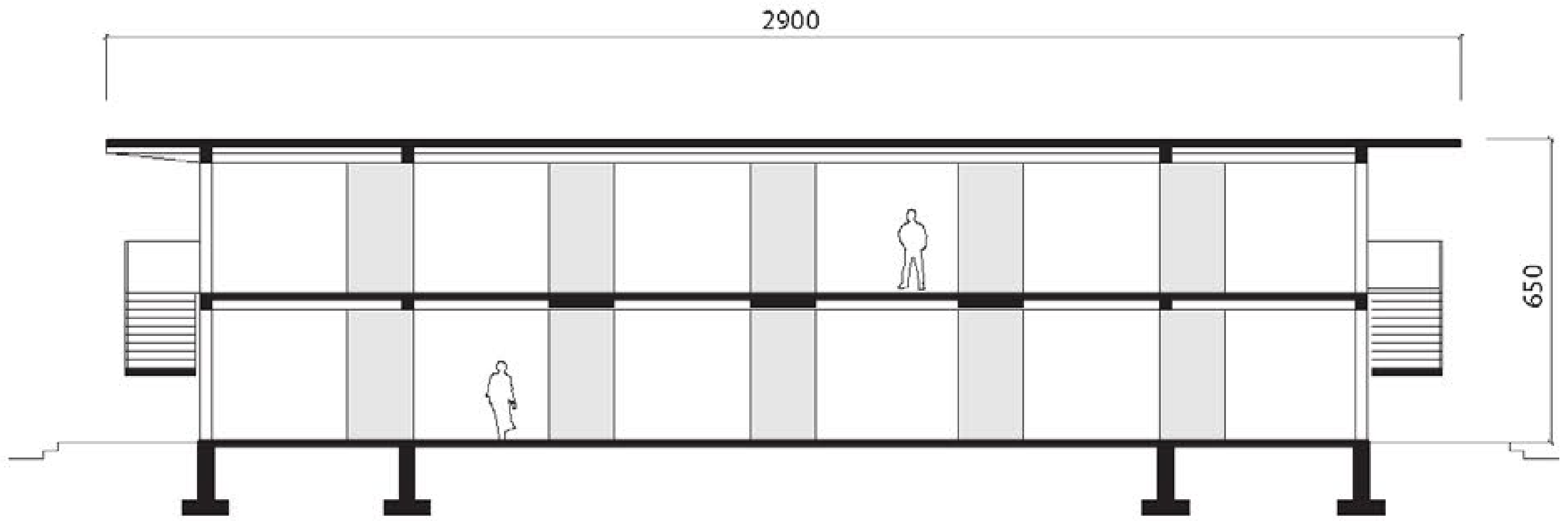


1er étage type



Coupe transversale


Façade laterale



Coupe Longitudinale


Façade principale

Minsitère de l'Education Nationale et de la Formation Professionnelle MENFP
Plany-types pour écoles fondamentales

MC-3 & 2x50

Modèle de base en maçonnerie chaînée

Utilisation:

Espaces : 3 & 2 classes de 50 m2
Capacité : 120 & 80 places-él. (40/cl.)
Utilisation : classes, administration bibliothèques, salles spéciales

Conditions / recommandations :

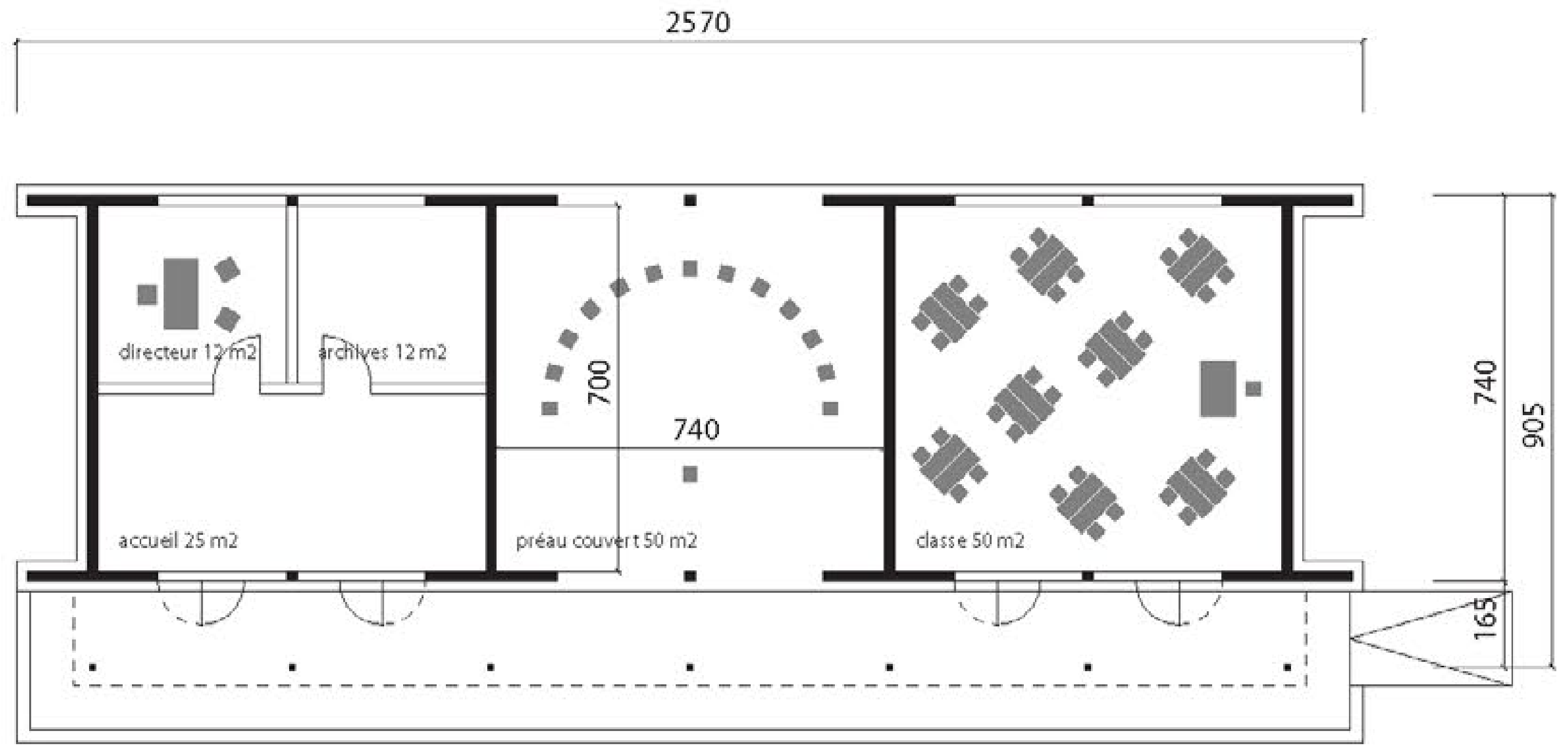
Zones : Toutes zones accessibles
Accès : carrossable
Maîtrise d'ouvrage: décentralisée
Firmes : PME locale et communauté

Construction:

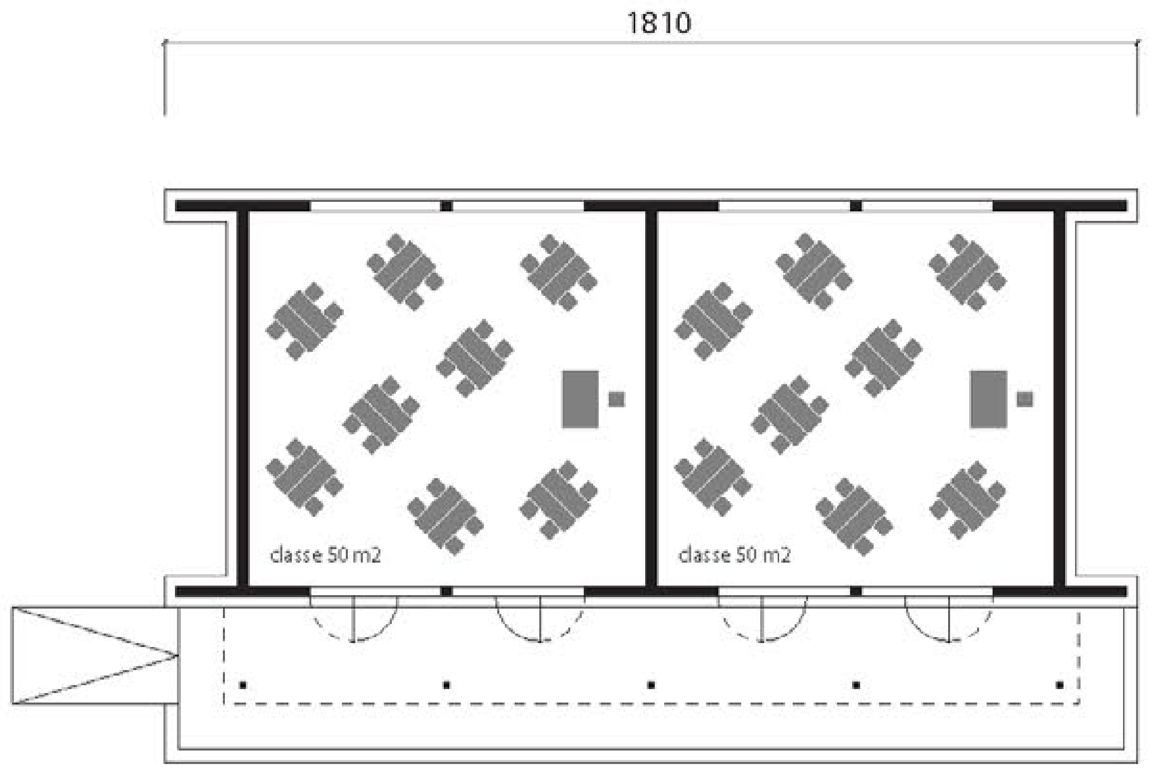
Structure : Maçonnerie chaînée
Toiture : bois ou métal, tôles
Parois intérieurs : bois ou panneau
Portes-fenêtres : métallique grillagé

Surfaces:

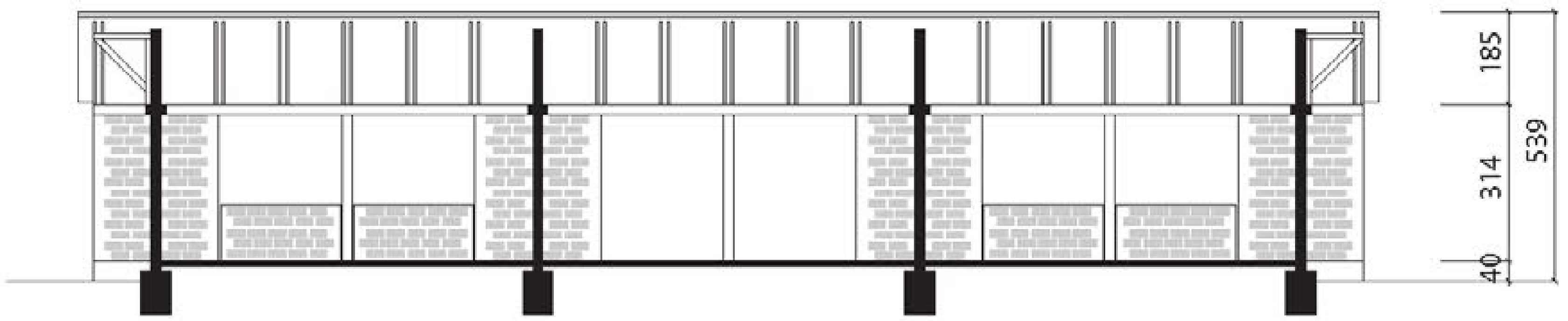
Surface brut : 245 m2 (3x) et 175 m2 (2x)
Surface utile : 150 m2 (3x) et 100 m2 (2x)
Surface au sol : 245 m2 (3x) & 175 m2 (2x)
Surface toiture : 245 m2 (3x) et (175 m2 (2x)



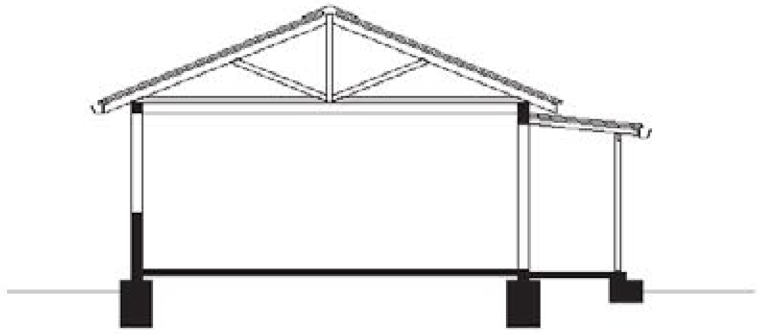
Plan

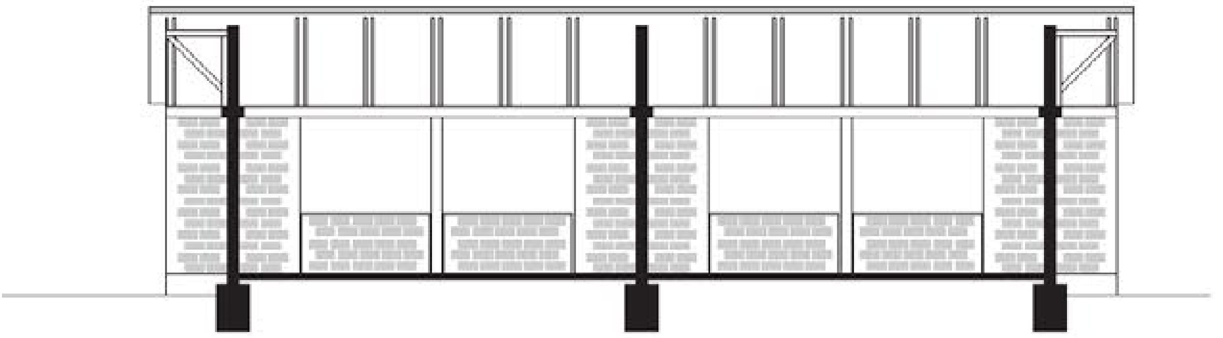


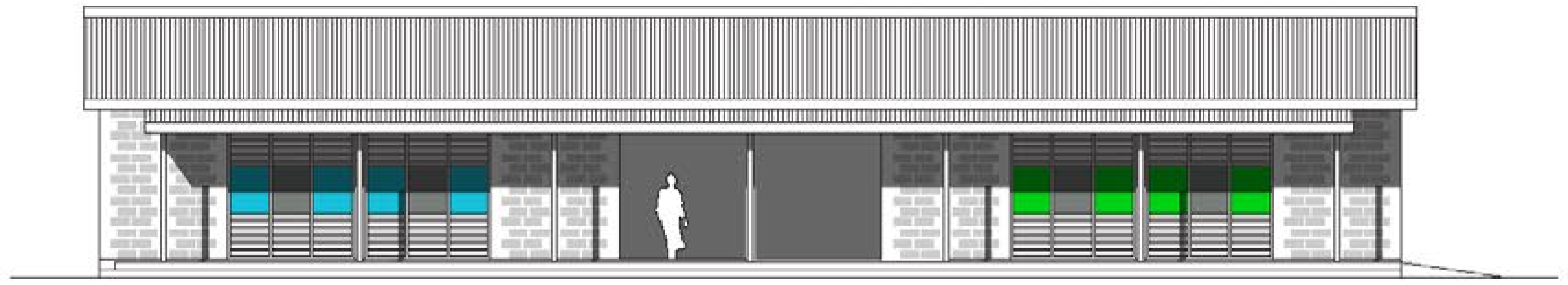
Plan

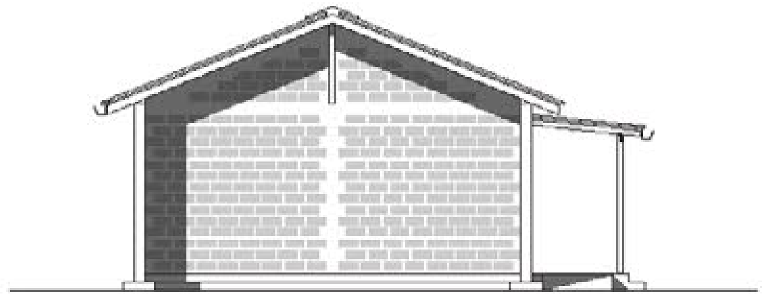


Coupe longitudinale

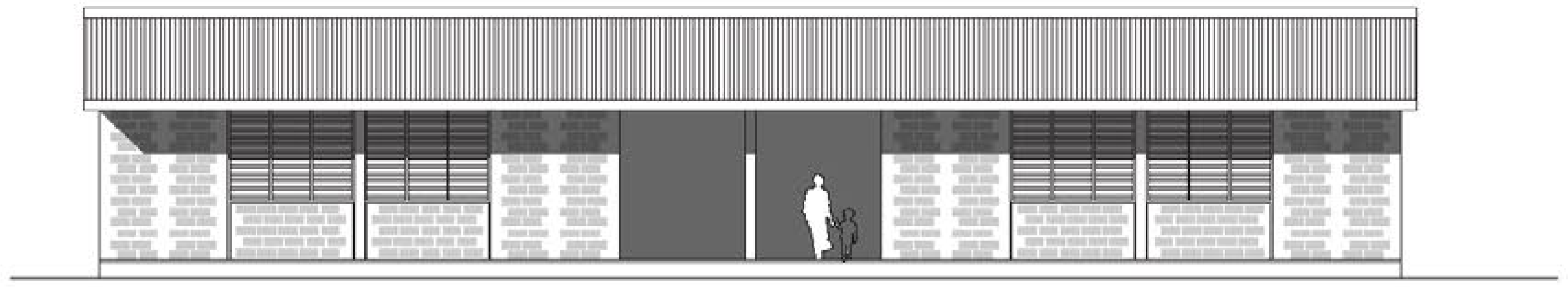

Coupe transversale

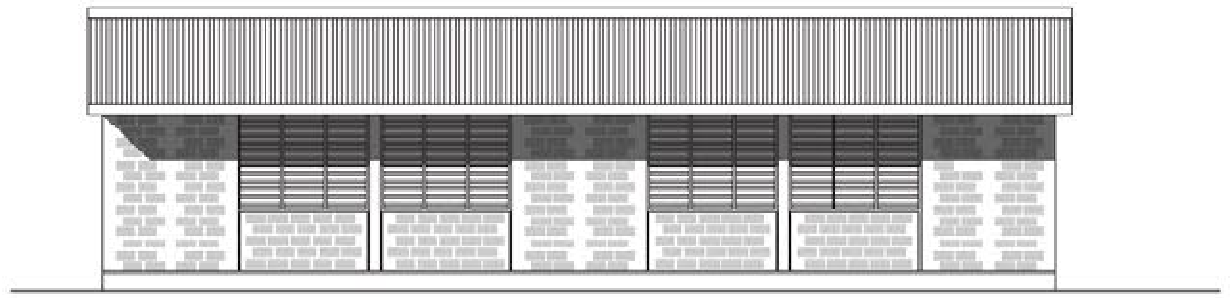

Coupe longitudinale


Façade frontale


Façade latérale


Façade frontale


Façade arrière


Façade arrière

Minsitère de l'Education Nationale et de la Formation Professionnelle MENFP
Plany-types pour écoles fondamentales

OB-2 & 1x50

Modèle en ossature bois pour zones reculées

Utilisation:

Espaces: 1 / 2 classes de 50 m2
Capacité: 40 / 80 places-él. (40/cl.)
Utilisation: classes, administration bibliothèques, salles spéciales

Conditions / recommandations :

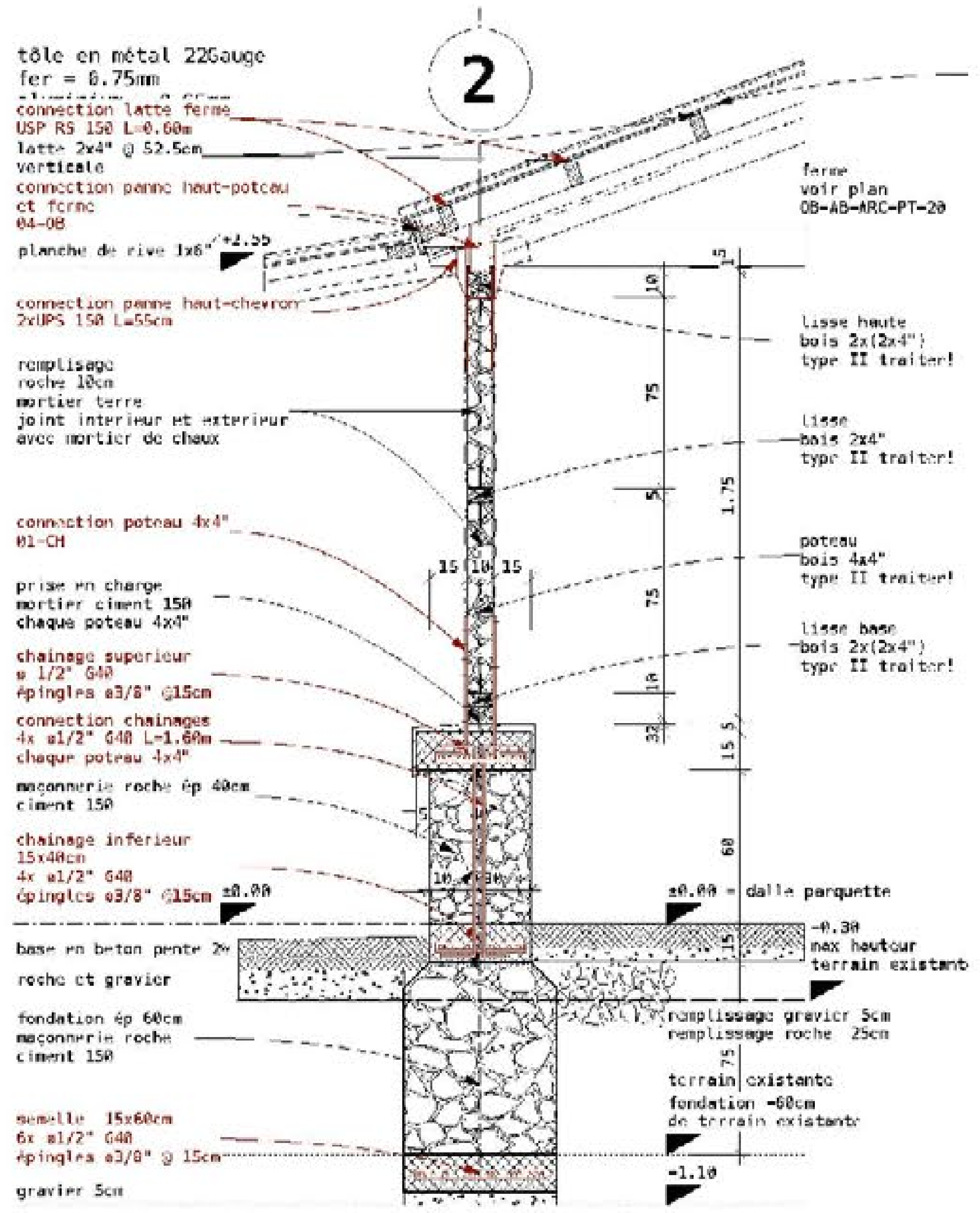
Zones: Zones reculées difficile d'accès
Accès: à pied
Maîtrise d'ouvrage: décentralisée
Firmes: PME locale et communauté

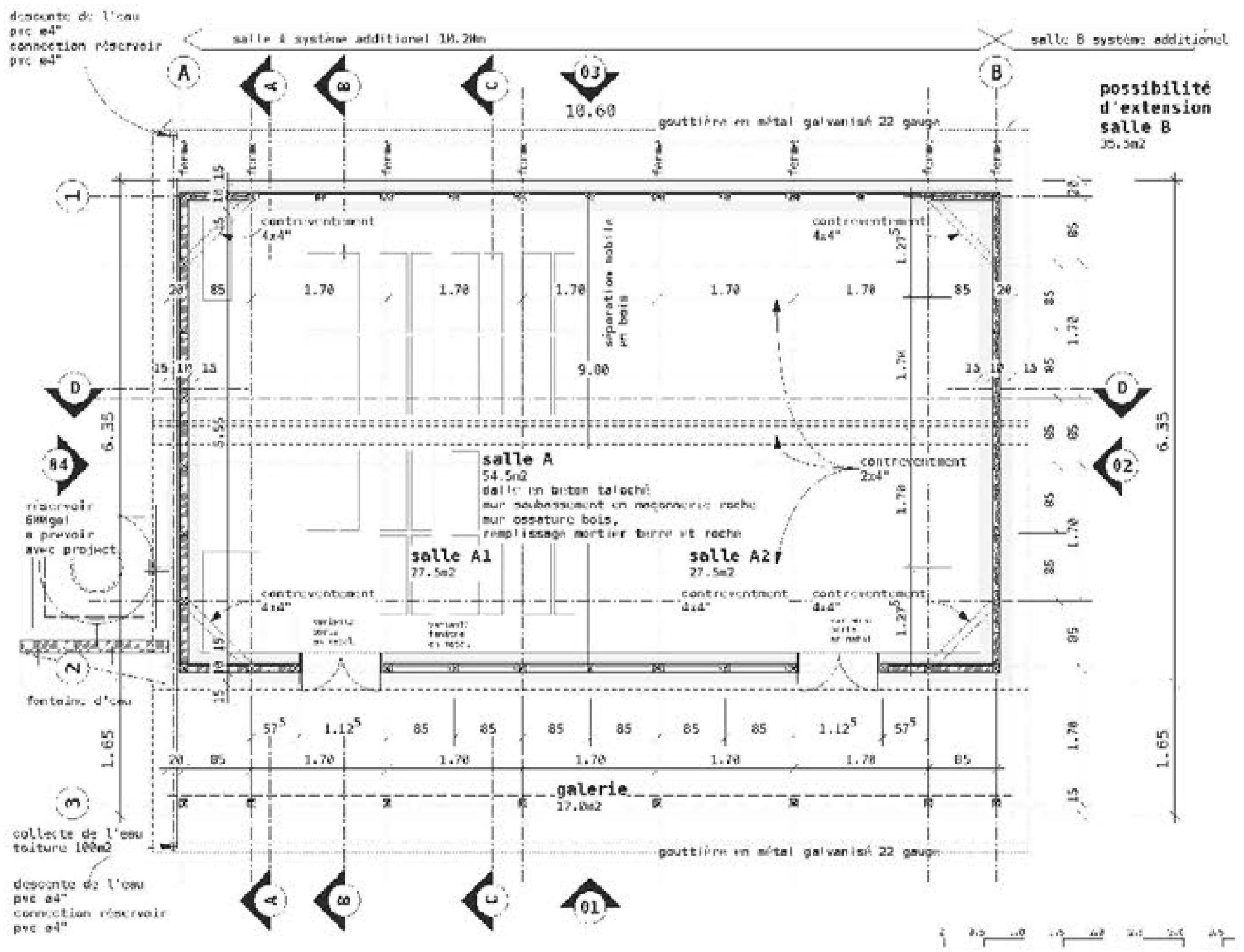
Construction:

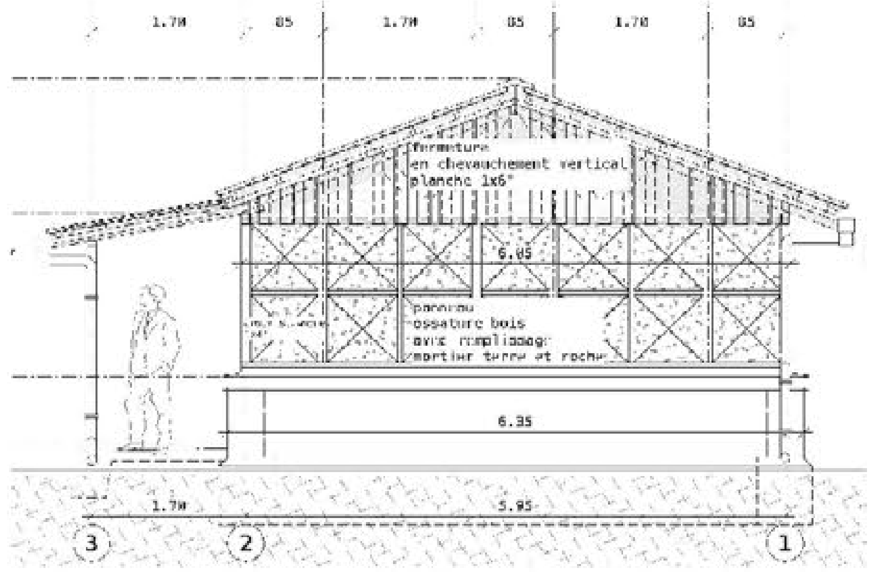
Structure: Ossature en bois
Toiture: bois et tôles
Remplissage: roches et mortier terre
Portes-fenêtres: lamelles de bois

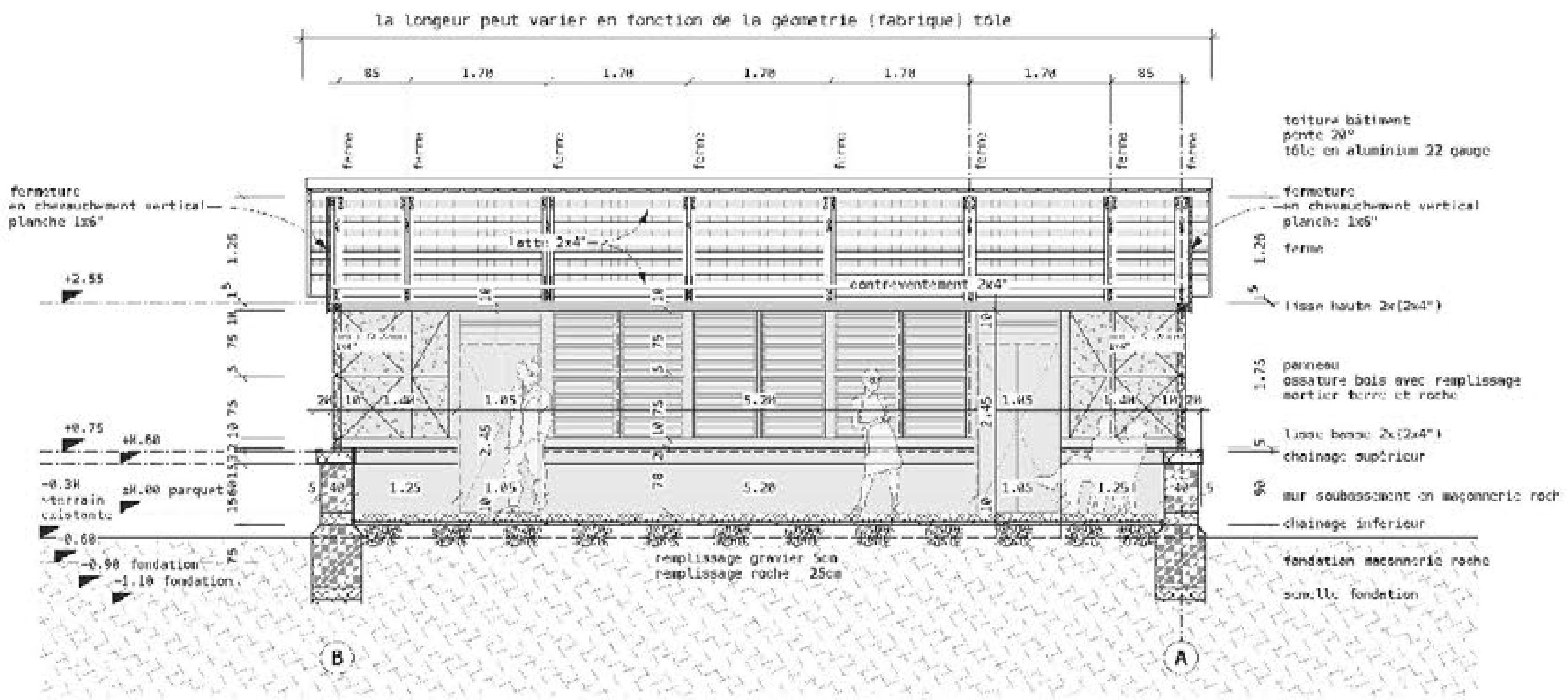
Surfaces:

Surface brut: de 55 à 85 m2
Surface utile: de 50 à 60 m2
Surface au sol: de 55 à 85 m2
Surface toiture: de 60 à 90 m2









Minsitère de l'Education Nationale et de la Formation Professionnelle MENFP
Plany-types pour écoles fondamentales

SAN-1

Modèle sanitaire de base (DINEPA) à consommation réduite d'eau

Utilisation / capacité :

Bloc G : env. 180 garçons
Bloc F : env. 180 filles
Bloc Préscolaire : env. 50 pupilles
Bloc Adultes/Hand. : env. 15 pers.

Conditions / recommandations :

Zones : toutes zones
Consommation en eau : réduite
Maîtrise d'ouvrage: décentralisée
Firmes : PME locale et communauté

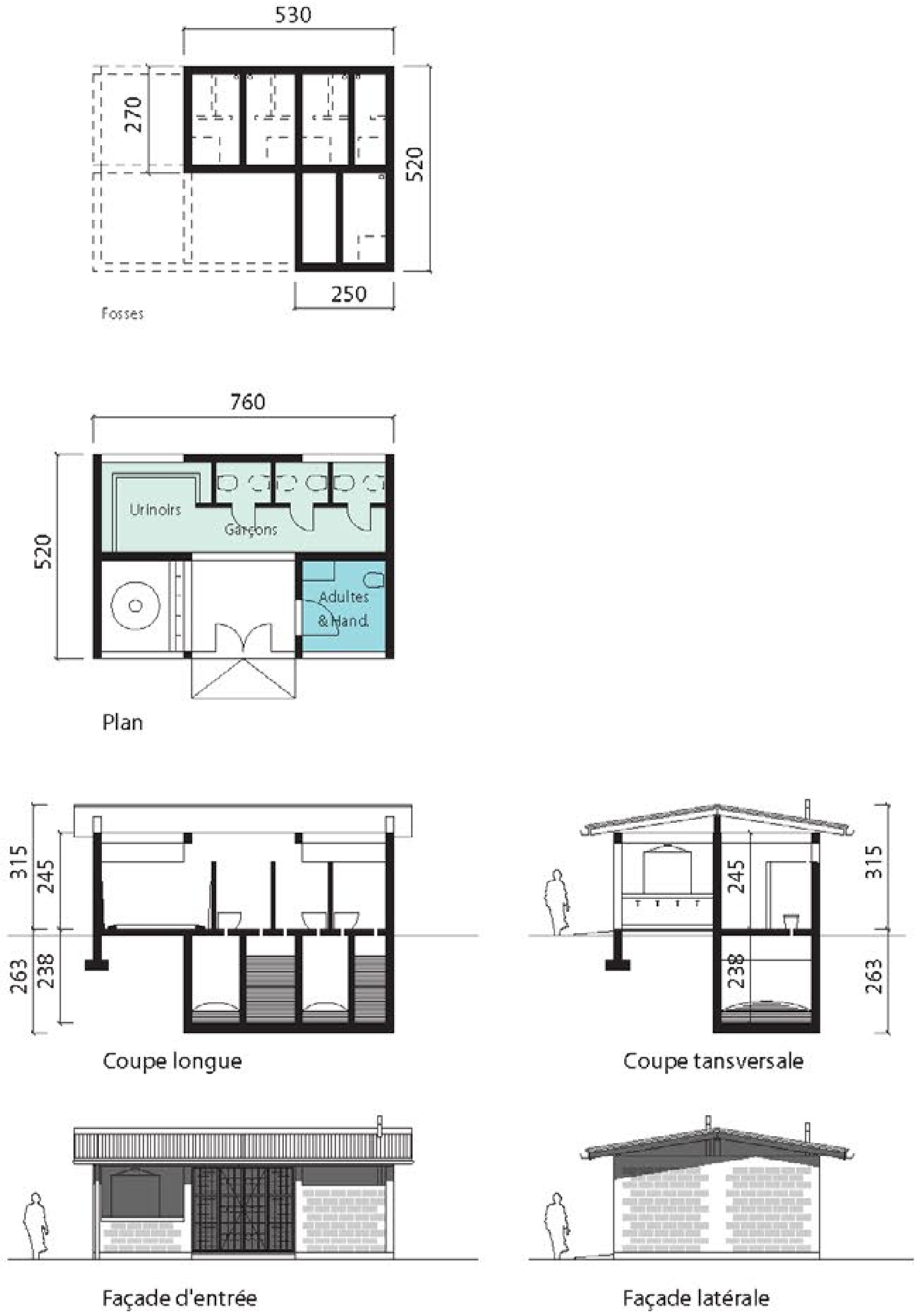
Construction:

Structure : Maçonnerie chaînée
Toiture : bois ou métal, tôles
Parois intérieurs : bloc ciment 10 cm
Portes-fenêtres : métallique grillagé

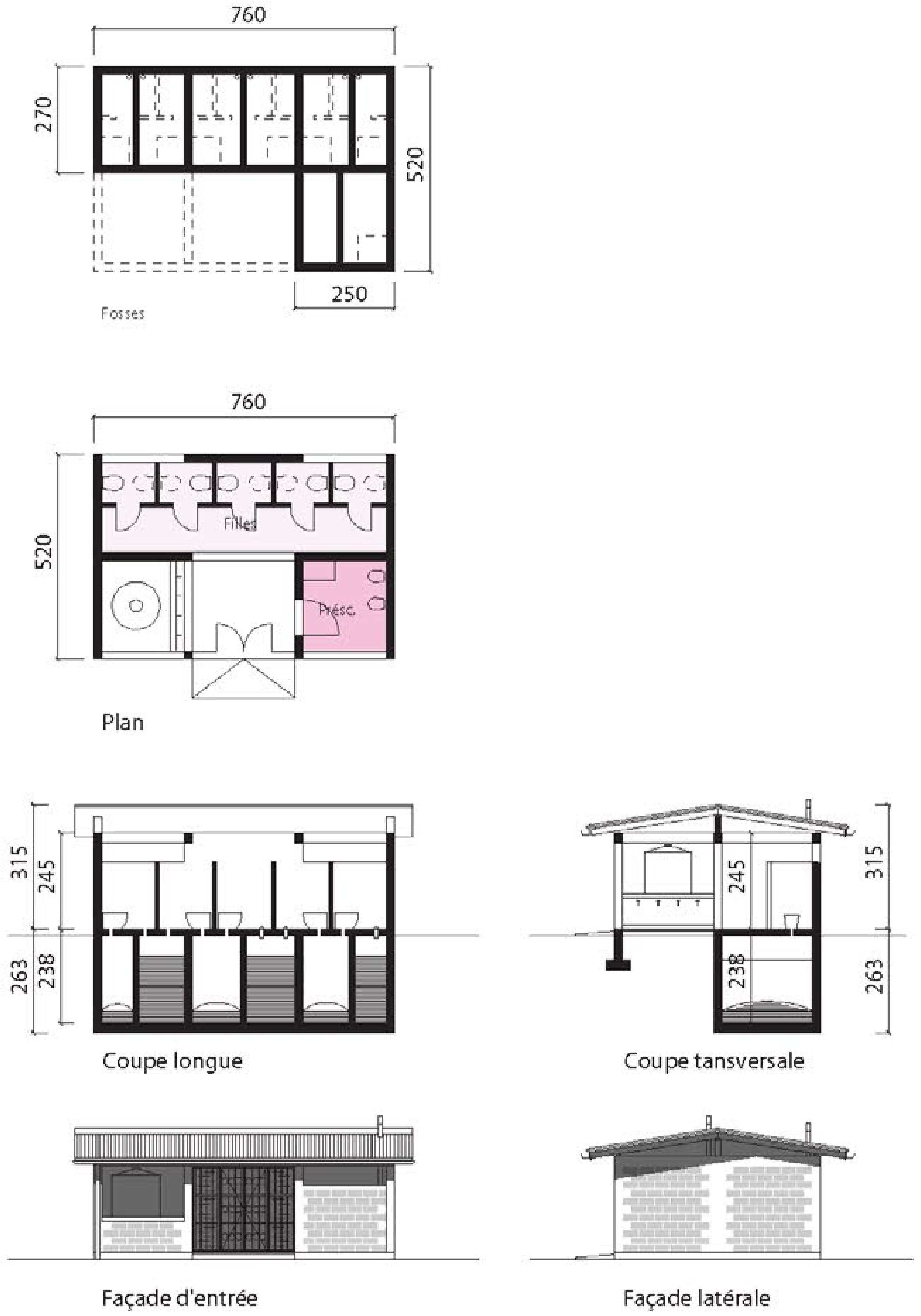
Surfaces:

Surface brut : 40 m2
Surface utile : 34 m2
Surface au sol : 40 m2
Surface toiture : 50 m2

BLOC G
Garçons avec cabine "Adultes & Handicapés"



BLOC F
Filles avec cabine "Préscolaire"

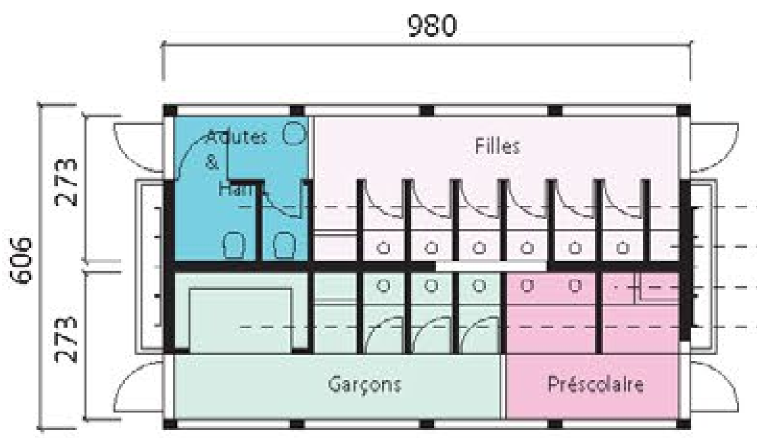


Minsitère de l'Education Nationale et de la Formation Professionnelle MENFP
Plany-types pour écoles fondamentales

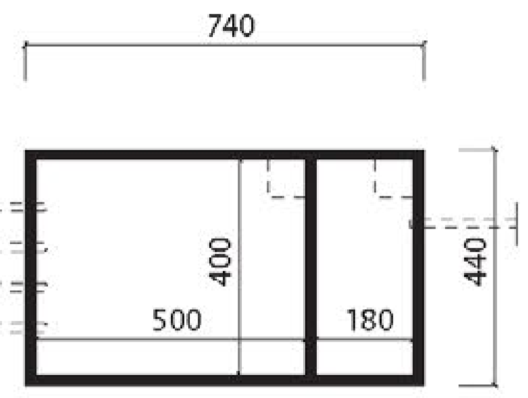
SAN-2

Modèle à chasse commune pour zones à bonne disponibilité en eau

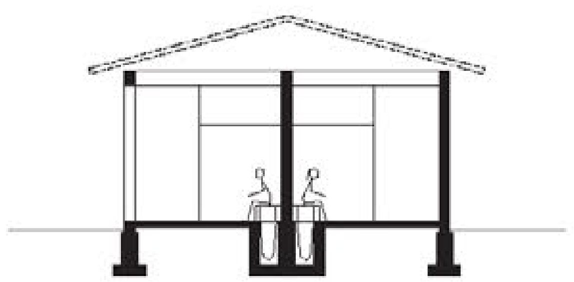
Utilisation / capacité :	Conditions / recommandations :	Construction:	Surfaces:
Bloc G : env. 180 garçons Bloc F : env. 180 filles Bloc Préscolaire : env. 50 pupilles Bloc Adultes/Hand. : env. 15 pers.	Zones : toutes zones accessibles avec une bonne disponibilité en eau Besoins en eau:	Partie fermée : Maçonnerie chaînée Toiture : bois ou métal	Surface brut : 60 m2 + 32 m2 réservoir Surface utile : 50 m2 Surface au sol : 60 m2 + 32 m2 réservoir Surface toiture : 70 m2

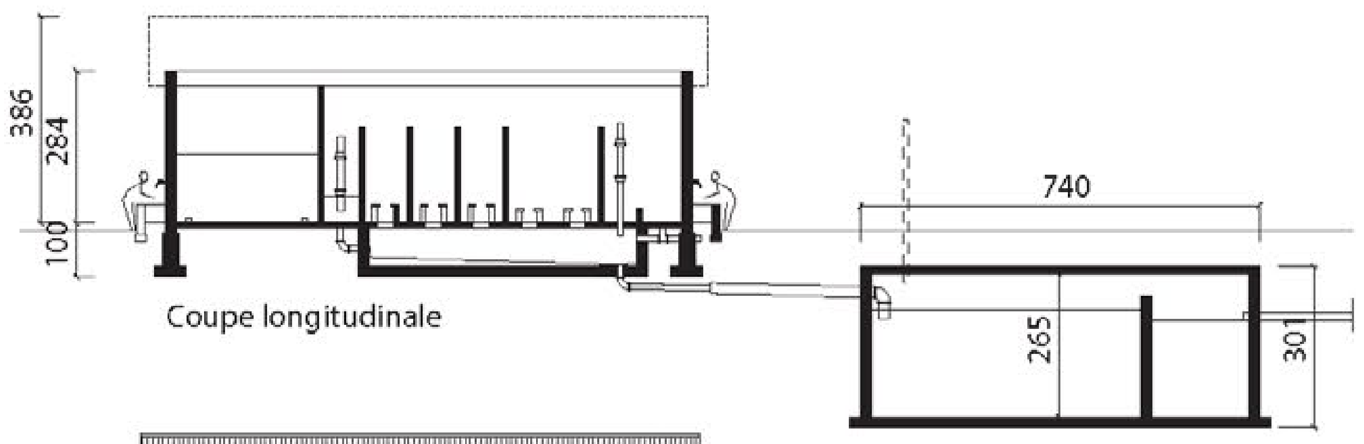


Plan

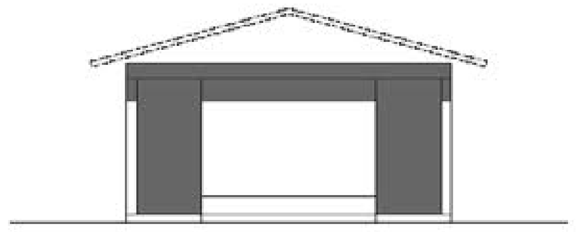


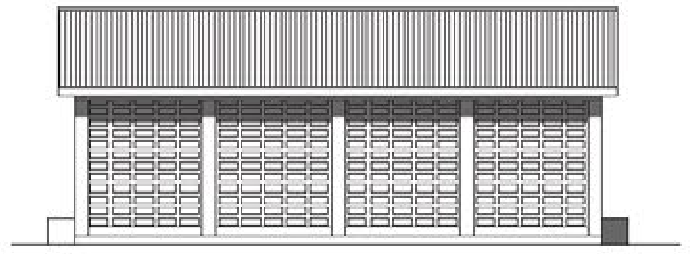
Fosse séptique


Coupe transversale



Coupe longitudinale


Façade frontale

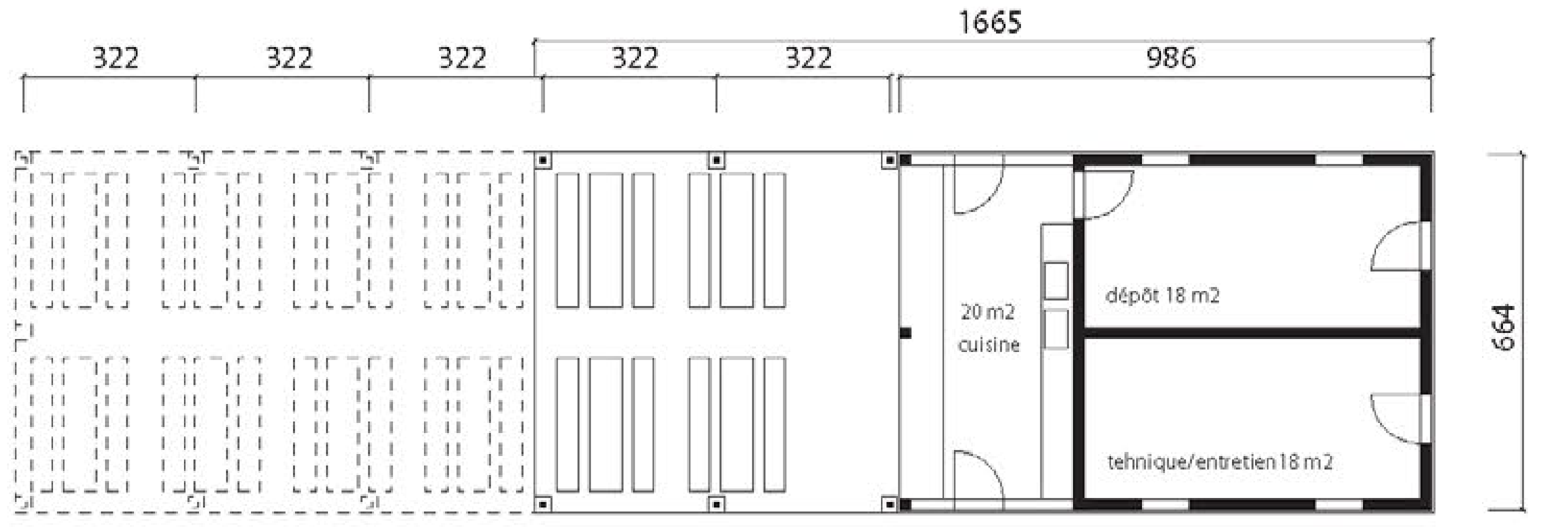

Façade latérale

Minsitère de l'Education Nationale et de la Formation Professionnelle MENFP
Plany-types pour écoles fondamentales

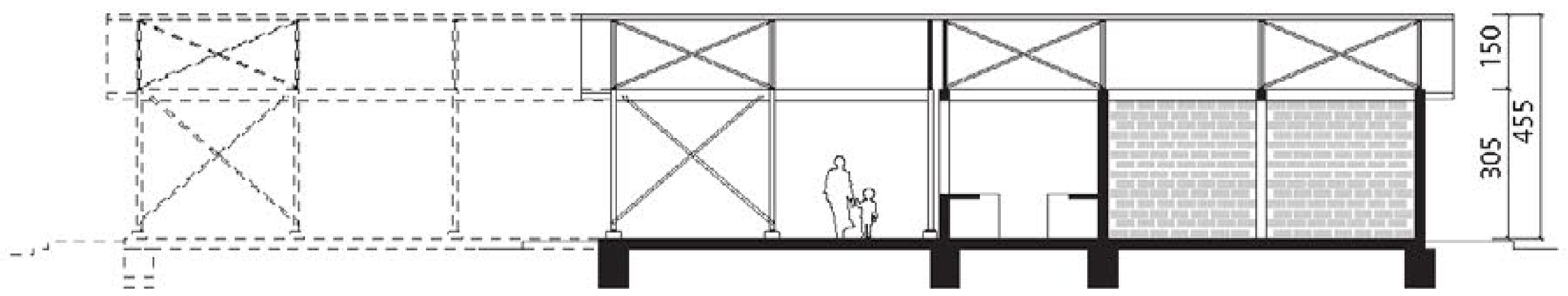
CAN-1

Modèle de cantine scolaire avec réfectoire etensible

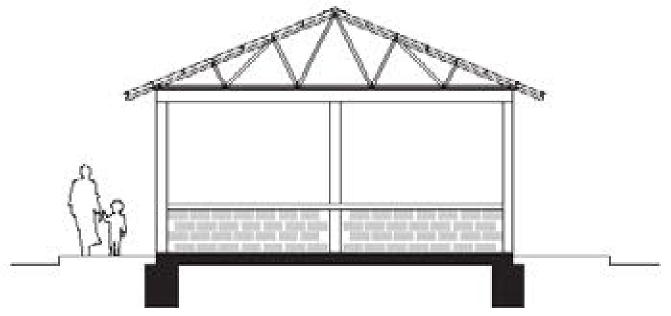
Utilisation:	Conditions / recommandations :	Construction:	Surfaces:
Espaces : 65 m2 fermé + 42 m2 de couvert extensible	Zones : Toutes zones accessibles	Partie fermée : Maçon.chaînée	Surface brut : 112 m2 (extensible)
Capacité: module de 25 places	Accès : carrossable	Partie couverte : Profilés métalliques	Surface utile : 100 m2 (extensible)
Utilisation: cantine et réfectoire	Maîtrise d'ouvrage : décentralisée	Toiture : métal, tôles	Surface au sol : 112 m2 (extensible)
	Exécution : firmes spécialisées (toiture métal)		Surface toiture : 130 m2 (extensible)



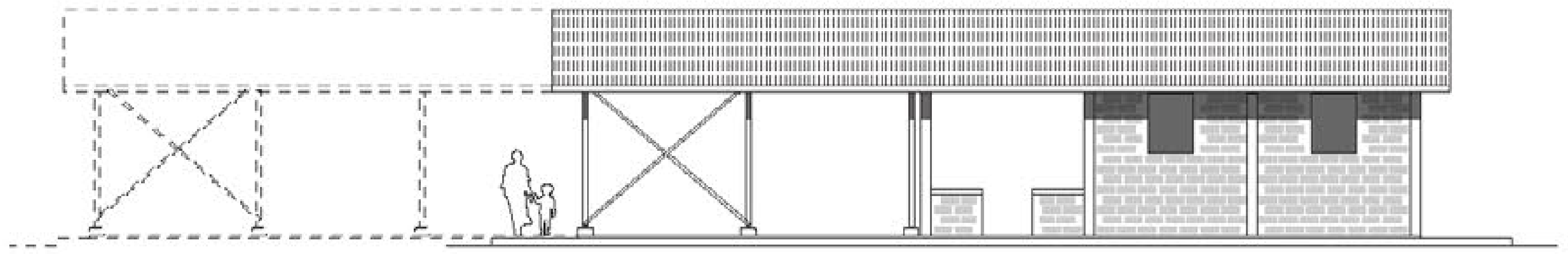
Plan



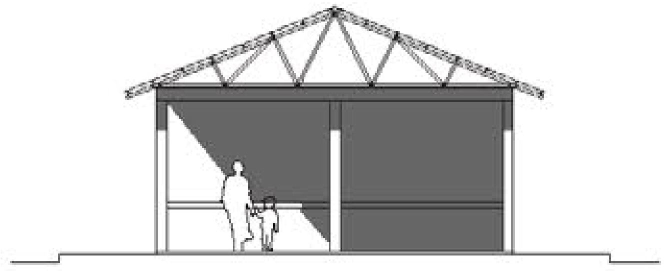
Coupe longitudinale



Coupe transversale



Façade latérale

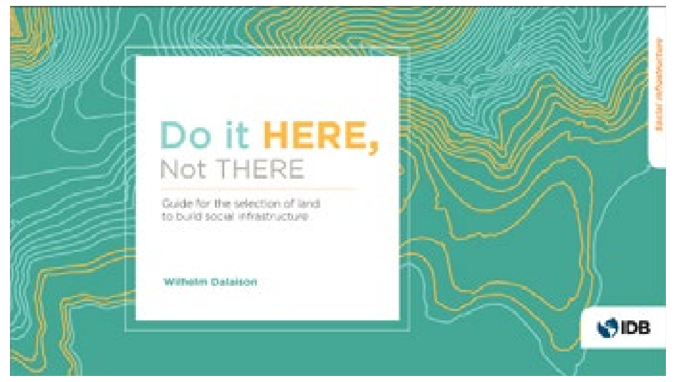


Façade frontale

Annex 4

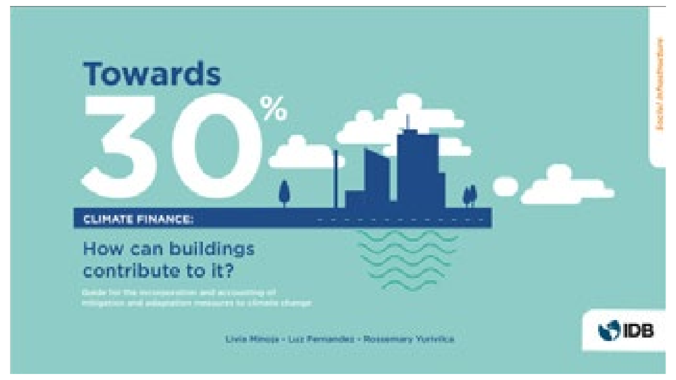
SIU publications (English Version)

[+ Sun + Light: Practical Guide for the Implementation of Photovoltaic Systems in Social Infrastructure Projects]



[Do it Here, Not There: Guide for the Selection of Land to Build Social Infrastructure]

[Design Well, Build Better: A Guide for Planning, Creating, Overseeing, and Making Decisions about Social Infrastructure Designs]



[Towards 30% Climate Finance: How Can Buildings Contribute to it?: Guide for the Incorporation and Accounting of Mitigation and Adaptation Measures to Climate Change]

[Goodbye Barriers! A Guide to Design More Accessible Spaces]

[Design & Build for Hospitals: How Can We Improve the Performance of Infrastructure Projects in the Region?]

Green Buildings for The Health Care Sector: Cost-effective Measures for Sustainable Design

[Green Procurement: How to Encourage Green Procurement Practices in IDB Funded Projects?]

[Strategies for School Reopenings during the COVID-19 Pandemic]

Social Infrastructure

10 years

School construction in Haiti

Technical learnings from a multiple construction program

Christian Ubertini
edited by Livia Minoja

IDB