


School Infrastructure Resilience

CoLab Workshop in Cali, Colombia

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100 RESILIENT CITIES

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Contents

1.0 School Infrastructure Resilience: Global Challenges

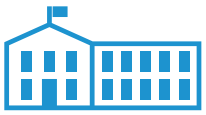
Educational infrastructure in most countries around the world is underfunded and over-extended, and schools are more vulnerable to natural hazards than other building types[1], not only putting children at significant risk, but also reducing the quality of education and limiting opportunities for economic and social growth and other community benefits. Furthermore, in the wake of natural disasters, despite best intentions to 'build back better', the opportunity to leverage investment in the reconstruction of schools has in some cases been lost due to lack of advance preparation and capacity for recovery and reconstruction.

Educational infrastructure in most countries is underfunded and schools are more vulnerable to natural hazards than other building types.

Deficiencies in School Infrastructure

Globally, there is an insufficient supply of schools to meet demand. According to UNESCO, approximately 10% of children and youth are not enrolled in primary and secondary education. Existing schools are either at or over capacity, and the vulnerability of these buildings to natural hazards such as earthquakes, typhoons and floods is for the most part unknown. However, the tragic destruction resulting from recent natural disasters is clear evidence that schools across the world both in the Global North and South are extremely vulnerable to natural hazards[2]:

1 Rodgers, J. Why Schools are Vulnerable to Earthquakes, Geohazards International.
2 Towards Safer School Construction: A Community-based Approach, Global Alliance for Disaster Risk Reduction & Resilience in the Education Sector



UNITED STATES

700 schools
had to be closed due to significant damage resulting from Hurricane Katrina in the United States in 2005

PAKISTAN

80% of schools
(10,000 buildings) were destroyed and more than 17,000 students were killed in the 2006 Kashmir earthquake in Pakistan

MYANMAR

2,460 schools
were destroyed by Cyclone Nargis in Myanmar in 2008

CHINA

Over 10,000 students
were killed by school collapses resulting from the 2008 Sichuan earthquake

HAITI

80% of schools
were either damaged or destroyed by the 2010 Haiti earthquake

CHILE

1.25 million students
were displaced by the closing of more than 6,000 damaged or destroyed schools in Chile following the 2010 earthquake and tsunami

PHILIPPINES

2500 schools
were damaged by Typhoon Haiyan in the Philippines in 2013

NEPAL

8000 school buildings
(33,000 classrooms) were destroyed and over 14,000 were damaged by the 2015 Gorkha earthquake in Nepal

Impacts on Urban Community Resilience

The inadequate supply of educational facilities in communities around the world coupled with the vulnerability of schools to natural disasters impacts general community welfare and long-term resilience in a multitude of ways beyond the immediate risk of collapse posed by the schools themselves:

> Inadequate space, lighting, ventilation, and sanitation as well as the use of toxic construction materials in schools pose health risks for students and teachers and reduce the quality of the environment in which education occurs, which in turn increases the likelihood of student absence or disenrollment, leading to increased risk of exploitation or neglect2 and reduced job preparedness.

An inadequate supply of local schools forces students to travel long distances, exposing them to dangerous road conditions and reducing the amount of time they can devote to their studies and other productive activities. It also increases the likelihood of absenteeism.

The closing of schools in the event of a natural disaster disrupts the education system for prolonged periods of time and prevents parents from returning to work, resulting in substantial losses of productivity and economic gains, pushing many families back into poverty.

Leveraging Disaster as Opportunity

While the widespread destruction caused by a natural disaster should be leveraged as an opportunity to build safer schools in way that enhances community resilience, in many cases, this opportunity is lost. National and local governments are typically not prepared in advance with the technical resources, human resources, and operational plans to mobilize quickly and make use of the substantial funds that flow in after a disaster to rebuild in a more resilient way. The political pressures to get children back in school quickly favor rapid construction processes that in many cases are contrary to building safe schools and increasing community resilience. For example, in the name of efficiency, construction responsibility may be outsourced to a private contractor who uses construction materials, techniques, and labor that are not appropriate for the local context. This practice not only limits opportunities for local capacity building through construction training of local contractors and economic development through local jobs and local material supply chains, but also, it reduces the likelihood of quality control because the contractor has limited incentive to increase quality at added cost to ensure safe construction techniques are adhered to. While a community-driven reconstruction program would be more appropriate for achieving resilience outcomes, in many cases, it is simply not practical because of the amount of effort and human resources required to rebuild on such a massive scale. If cities were better prepared in advance to accept and plan for this reality, they would be in a better position to pursue community-driven reconstruction programs.

Existing Efforts on School Safety

The problem of vulnerable schools is not unstudied. Ongoing efforts by various organizations to address the issue of 'safe schools' include UNISDR's Worldwide Initiative for Safe Schools (WISS), World Bank GFDRR's Global Program for Safer Schools (GPSS) and the Global Alliance for Disaster Risk Reduction and Resilience in the Education Sector (GADRRRES). The focus of the efforts identified above has largely been on improved safety - i.e. reducing the vulnerability of schools to natural hazards such as earthquakes, typhoons and floods (with an emphasis on earthquakes) and increasing awareness of natural hazard risk by enhancing school curricula.

2.0 CoLab Objectives and Process Overview

A 100RC CoLab is a convening of Platform Partners and Subject Matter Advisors, with a city or cities, to drive innovation and collaboration in response to a particularly complex city resilience challenge. CoLab challenges reflect multi-city demand and typically require a cross-industry or cross-discipline, multi-partner response. Because the topic of school resilience is inherently crosscutting, and because it has emerged as an area of interest in resilience planning in numerous cities in the Network, 100 Resilient Cities identified an opportunity to develop a more holistic perspective on this global challenge through a CoLab, using Cali, Colombia, a city which is making a major investment in building the resilience of its school infrastructure, as a practical first application of the effort. The objective of the CoLab was to identify recommendations and develop solutions for Cali that both reduce school vulnerability and create opportunities for economic, social and environmental benefits which further support and incentivize investment in risk reduction.

CoLab challenges reflect multi-city demand and typically require a cross-industry or cross-discipline, multi-partner response.

The CoLab workshop took place over 3 days (20-22 February 2018) in Cali, Colombia. Participants included staff from six Cali government agencies, in addition to non-local subject-matter experts:

CALI GOVERNMENT

CALI RESILIENTE OFFICE
DEPARTMENT OF EDUCATION
DEPARTMENT OF DISASTER RISK MANAGEMENT
DEPARTMENT OF PLANNING
DEPARTMENT OF SPORTS AND RECREATION
PARTICIPATION AND TERRITORIAL DEVELOPMENT

NON-LOCAL SUBJECT MATTER EXPERTS

AECOM
AIR WORLDWIDE
AMERICAN INSTITUTE OF ARCHITECTS (AIA)
BUILD CHANGE
FINDETER
GEOHAZARDS INTERNATIONAL (GHI)
GLOBAL EARTHQUAKE MODEL FOUNDATION (GEM)
INTERNATIONAL CODE COUNCIL (ICC)
INTER-AMERICAN DEVELOPMENT BANK (IDB)
MEXICO CITY OFFICE OF RESILIENCE
WORLD BANK GFDRR
WSP
DR. FRED KRIMGOLD AND BARBARA KRIMGOLD

The CoLab included the following activities:

Collective visioning exercises on resilience in school infrastructure to develop specific design and operational recommendations and resource references for Cali which are also transferrable to other 100RC network cities

A problem tree analysis to better understand the root causes of inadequate school infrastructure as both a global problem and a local problem in Cali as a first step to identify gaps and needs

An innovation sprint to identify and develop initiatives Cali could consider for improving the resilience of its school infrastructure and to identify resources available from 100RC partners for advancing these initiatives

Site visits to educational facilities in Cali. John F Kennedy School in District 18 (top row), Early Childhood Development Center in Altos de Santa Elena Urban Zone (bottom row).

3.0

Case Study:
School Infrastructure Investment in Cali, Colombia

Additionally, site visits to existing and planned schools around the city were conducted to provide more local context for foreign participants. The City of Cali, Colombia, with a population exceeding 2 million inhabitants, is located in an area of high seismic risk and faces the regular threat of rainfall and riverine flooding. In Colombia, which has a decentralized education system, funding and control of schools occurs at the local level as opposed to the national level. The Chief Resilience Officer (CRO) of Cali, Colombia Vivian Argueta is leading one of the most ambitious interventions in the city that will overhaul the education system and infrastructure. The initiative, called "My Community, My School", aims to strengthen the educational infrastructure of Cali for early childhood education, primary, secondary and high school. Through new construction, retrofit and rehabilitation, the initiative aims to impact the resilience value of more than 50% of the 342 school buildings in the city. The effort is focused both on improving earthquake and flood safety and preparedness and on providing broader community benefits through school infrastructure and programs. The total cost of the initiative is estimated at US $120 million to be disbursed during the period 2017-2020.

"My Community, My School" aims to impact the resilience value of over 50% of Cali's 342 school buildings.

As part of the CoLab, participants visited three educational facilities around the city of Cali to get a sense for the diversity of infrastructure currently in place and diversity of communities served by this infrastructure. The schools visited include:

Site Visit 1: La Inmaculada Concepcion located in Pichinde Rural Zone (existing school where a new facility will be added)

Site Visit 2: John F Kennedy School in District 18 (representative of 65% of the total educational facilities in Cali in terms of its building and facilities design)

Site Visit 3: Early Childhood Development Center in Altos de Santa Elena Urban Zone (built in 2015)

Additional information about Cali's program of investment in school infrastructure and the schools visited is provided in Appendix A.

La Inmaculada Concepcion located in Pichinde Rural Zone

What is School Infrastructure Resilience?

The participants and experts in the Cali CoLab had varied backgrounds, and each came to the workshop with differing perspectives on resilience as it relates to school infrastructure, some approaching resilience through disaster risk management, others concentrating on climate and sustainability, and still others focused on social programs and community engagement. As a first step towards developing recommendations for Cali, participants engaged in a series of rapid exercises to align on a common understanding of resilience as it relates to school infrastructure and construct plans of their vision of a 'utopian' school.

Shocks and Stresses – WHY is resilience important?

Participants identified the following shocks and stresses as having the most significant impact on the design and operation of school infrastructure:

SHOCKS

- Earthquakes
- Infrastructure Failure
- Landslides
- Rainfall Flooding

STRESSES

- Aging Infrastructure
- Climate Change
- Crime/Violence
- Inadequate Infrastructure
- Poverty

Participants agreed that school infrastructure, if designed and operated with an eye towards resilience, has the potential to mitigate the following shocks and stresses:

SHOCKS

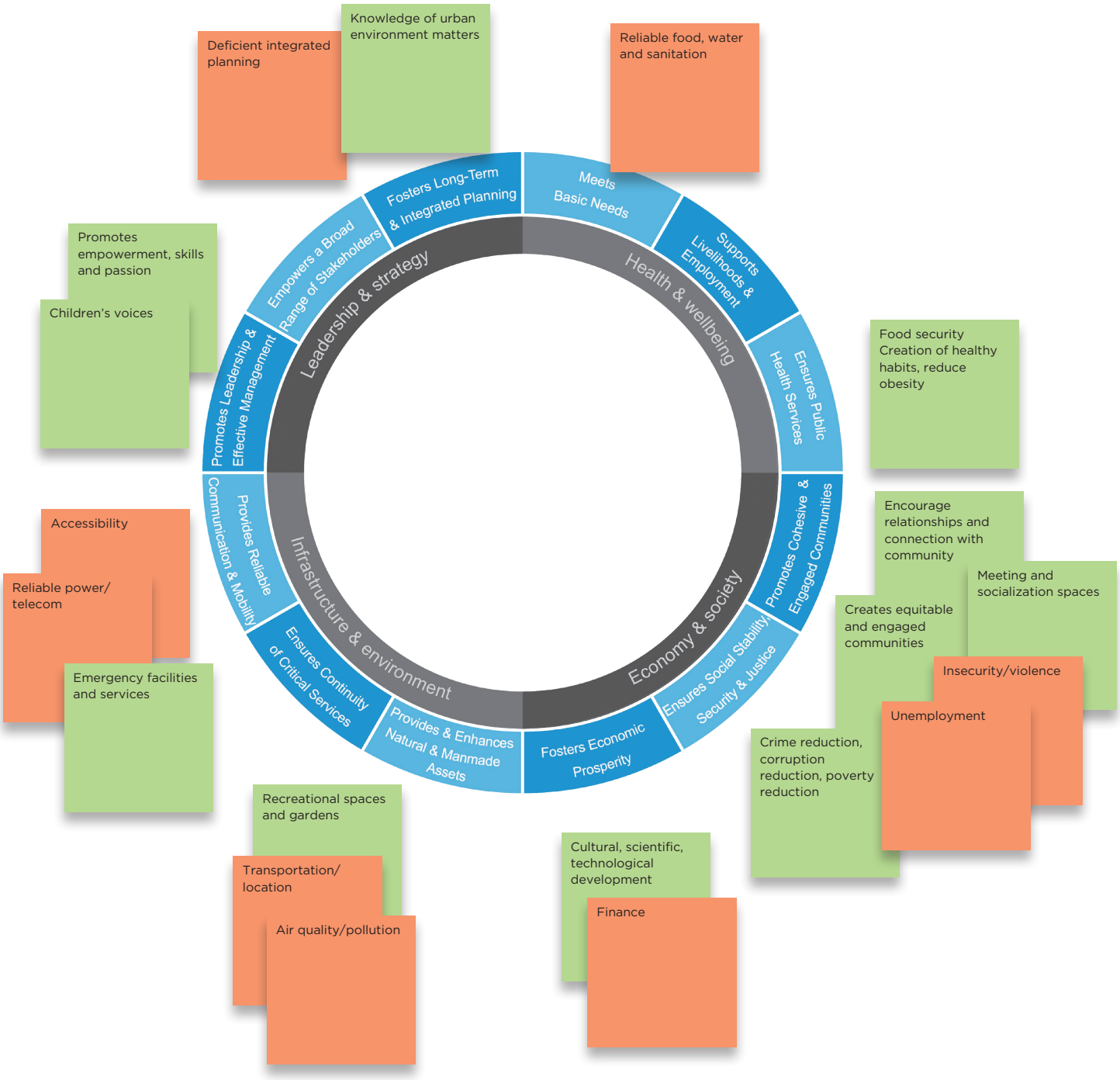
- Earthquakes
- Infrastructure Failure

STRESSES

- Crime/Violence
- Drug/Alcohol Abuse
- Lack of Social Cohesion
- Economic Inequality
- Gender Inequality
- Unemployment

Drivers of Resilience – WHAT drives school resilience?

Using the 'drivers of resilience' from the **City Resilience Framework**, participants identified the ways in which schools benefit a city ('Benefits') and the city functions that support schools or that schools rely upon to function and succeed ('Dependencies'). Below are a few examples mapped to the CRF (Benefits in green boxes, Dependencies in orange boxes):



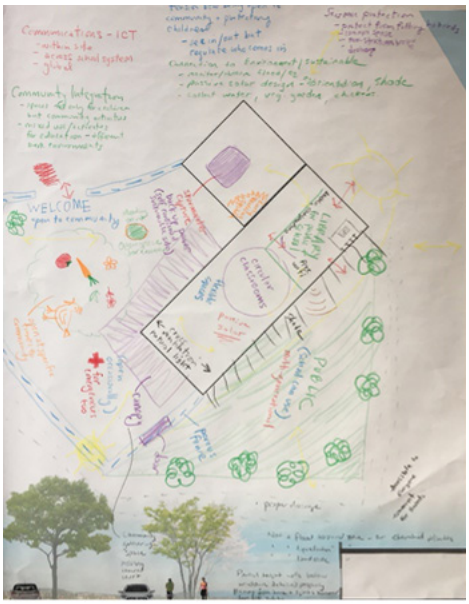
Qualities of Resilience – HOW can a school be resilient?

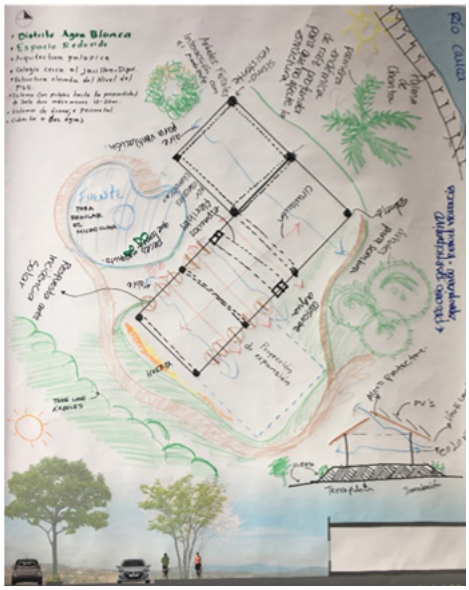
Participants then identified characteristics of school design and operations that illustrate the seven qualities of resilience: reflective, robust, flexible, integrated, resourceful, redundant, inclusive. Below are a few examples:

Quality	Definition	School Design Example	School Operations Example
REFLECTIVE	Using past experience to inform future decisions	Understanding natural hazard risks and site-specific risks and modifying the design accordingly	Understanding and planning for infrastructure interdependencies between schools and other related systems
ROBUST	Well-conceived and managed systems	Schools that can withstand earthquakes and floods with limited damage and impact to operations	Community connection and cohesiveness – teachers, staff and others
FLEXIBLE	Willingness, ability to adopt alternative strategies in response to changing circumstances	Building in green spaces and adaptable/flexible spaces within the school grounds	Shared spaces with communities based on an agreed upon schedule and program
INTEGRATED	Bring together a range of distinct systems and institutions	Schools across the city are planned and designed as a system, considering interconnectedness and community integration	Schools across the city are managed as a system
RESOURCEFUL	Recognizing alternative ways to use resources	Sustainable and passive design concepts integrated into the building design to reduce energy and water use	Finishings and furnishings are low-maintenance and durable to reduce O+M costs
REDUNDANT	Spare capacity purposively created to accommodate disruption	City understands which schools will need to used as emergency shelters and temporary schools are designs them to remain operational in an earthquake	Emergency plans are developed in advance of a disaster specifying where students will go to school if their school is damaged or needs to be used as a shelter
INCLUSIVE	Prioritize broad consultation to create a sense of shared ownership in decision-making	School designs that are adapt to local cultural conditions and needs	Responsibility for operations and maintenance is shared by the community

What does your Utopian school look like?

Participants used crayons and markers to sketch plans, sections and details of their vision of what a Utopian school would include. The following are four examples:





Examples of 'utopian' school designs from the visioning exercise

5.0 Getting to the Root of the Problem

After aligning on a vision for resilience in school infrastructure, participants engaged in an exercise to break down the common global challenge of achieving this vision. The challenge was stated as follows:

> **THE CHALLENGE**
> **Schools and support infrastructure are inadequate, poorly designed and vulnerable to natural and man-made hazards, exposing children to significant risks that they are unprepared to face and impacting the broader resilience of communities.**

The problem statement included the following three sub-problems which were tackled by three groups of participants with the objective of then developing solutions to address these key questions:

Problem Statement	Key Questions
1. New school construction and renovations of existing schools do not effectively reduce risk and build community resilience.	How to reduce vulnerability of existing school infrastructure (both facilities and the infrastructure systems in which they exist) to acute shocks (flood, earthquakes) as well as chronic stresses? How to maximize the resilience value and societal co-benefits from new investments in school construction (ie what are they and how can they be achieved)?
2. When a disaster does strike, governments do not use the opportunity to build back more resilient infrastructure.	How to prepare for response and recovery to a natural disaster with respect to school infrastructure in order to reduce disruption and leverage the disaster event as a resilience-building opportunity?
3. Schools do not take appropriate measures to educate occupants of the facilities and associated communities about the likely impacts of shocks and prepare them for these events.	How to limit the risk exposure of school children in the near term to natural disasters through preparedness measures while longer-term risk reduction strategies are being implemented?

For each sub-problem, the groups identified underlying causes or roots of the problem in the following categories: building regulations, design, O+M, funding, community integration, centralized vs decentralized approaches, risk awareness, construction materials and supply chains, politics and human behavior, and interorganizational communication. The root problems were a mix of global issues and ones that were specific to the Cali context. The complete problem tree is provided in Appendix B.

Key underlying 'root causes' of the problems that were identified by the groups include:

PROBLEM 1: New school construction and renovations of existing schools do not effectively reduce risk and build community resilience.

Example Root Causes:

- National regulations and standards are inflexible and not adaptable to specific local contexts and needs
- Lack of access to key information for decision-making (ie risk maps)
- Lack of mandate (through procurement) for design team to think bigger and more creatively about school facilities
- Designs do not consider future maintenance needs and associated costs
- Restriction of use of local materials and vernacular construction methods in rural areas – use of inappropriate materials for local context
- 'Value engineering' in design reduces resilience
- Lack of citizen participation in the planning and design processes for schools

PROBLEM 2: When a disaster does strike, governments do not use the opportunity to build back more resilient infrastructure.

Example Root Causes:

- Centralized approaches are frequently taken during reconstruction due to politics and time pressure
- There are no set parameters in place to determine the priority of interventions
- Local builders are not trained in hazard-resistant techniques
- Lack of forecasting of financial resources needed post-disaster based on risk assessment
- Corruption takes advantage of emergencies to divert economic resources to those other than affected populations
- Communities are not included in the development of plans and solutions
- Reactionary mindsets – the hazard is not a priority until after it happens
- Political interest – pressure to show results, recover quickly and put schools back in operation
- Institutions do not have the capacity or are not ready to execute on established priorities and use recovery funds that become available

» No systems in place for quick inspection of damaged buildings to speed re-occupation
» Post-disaster recovery requires new modes of working together across city departments and organizations

PROBLEM 3: Schools do not take appropriate measures to educate occupants of the facilities and associated communities about the likely impacts of shocks and prepare them for these events.

Example Root Causes:

» Technocrats, educators and communications teams are not connected and working together
» Where schools are designed as emergency shelters, there can be a lack of awareness on the part of staff and users of the impacts that this emergency function may have on the functionality of the school
» Lack of addressing non-structural falling hazards in schools
» Lack of funding for emergency preparedness programs
» Communities lack risk management and disaster response plans
» Distrust of authorities
» Lack of materials and compelling campaigns that inform citizens about existing risks

6.0 Best Practices and Recommendations for School Infrastructure Resilience

Through the CoLab, a set of best practices and recommendations for school infrastructure resilience was developed for Cali. The recommendations were organized into three categories related to school infrastructure:

Design-related recommendations, i.e. considerations for the planning and design phases of school infrastructure projects

Operations-related recommendations, i.e. considerations for the operation and maintenance of schools and associated programs, some of which may also influence the design of the facilities

Systems connections and related recommendations, i.e. considerations related to programs and opportunities that could be explored as parallel initiatives outside of the scope of a school infrastructure project

For each recommendation, participants listed 'inspirations' including precedents from other cities, case studies, and related resources where more information could be found. The full set of recommendations is provided in Appendix C. While this document was developed specifically for application to Cali, it contains many recommendations and resources that are relevant to cities around the world, and it is our hope that it serves as a useful resource to other cities and practitioners focusing on the topic of school infrastructure resilience.

Key recommendations included the following:

» The city should use a 'systems' or 'network' approach to allocate limited funds to retrofit existing schools and invest in new schools for multi-hazards. For example, while all schools should be retrofitted or built to be made 'life safe', not all schools need to be designed to an 'operational' performance level to

serve as emergency facilities. When the school system is viewed as a network as opposed to individual sites and a disaster response and recovery plan is put in place in advance of a disaster, it is possible to find efficiencies in the system.

» As part of the systems approach, the city should conduct a vulnerability assessment of its entire school infrastructure portfolio (starting with pre-1984 buildings, followed by 1985-2010 buildings) to identify those schools which are most vulnerable to earthquakes and floods. This information should be used to prioritize retrofits and new construction through a long-term mitigation plan.

» School retrofits can be phased over time to distribute cost and reduce disruption to operations.

» New school construction and retrofits for the purposes of risk reduction should be leveraged to create additional benefits to schools – for example, the introduction of passive design concepts to increase natural daylight and improve cross ventilation; use of durable finishings to reduce cost of maintenance and upkeep as well as materials to improve classroom acoustics; introduction of pervious surfaces and grass, trees and gardens to not only reduce flood risk but also create environmental learning opportunities.

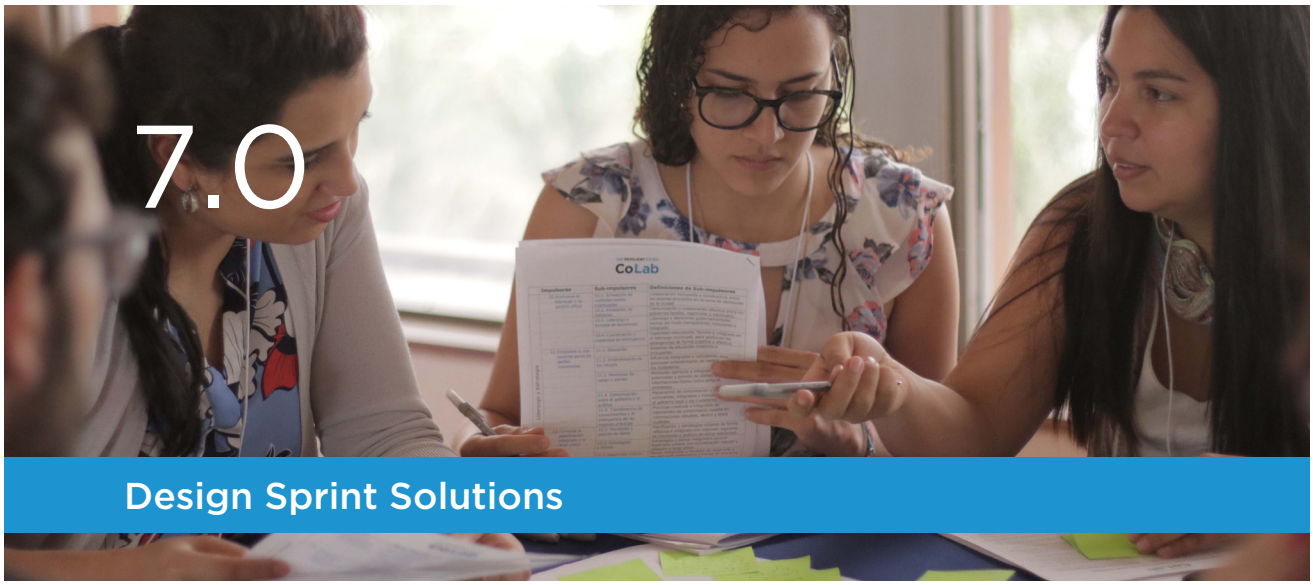
» Schools should be designed with flexible spaces allowing adaptability of use for both everyday and disaster situations as well as maximizing long-term utility of the facility.

» Schools and school grounds should be designed as multi-purpose, cultural utility for communities and accommodate interaction and partnership between students, teachers and communities. Avoid physical barriers that isolate schools from surrounding areas. Consider a layered approach with varying degrees of public and private facilities which can also provide resources and services to the wider community. For example, a central private and protected ‘core’ school for students; controlled public facilities such as libraries and community performance spaces surrounding it; and public parks accessible to students on the periphery.

» National regulations for school zoning should be updated to allow for more flexibility in their application to different local contexts and needs. Consider form-based and performance-based zoning approaches.

» Develop a program of co-management of facility maintenance, cleaning and improvements (and associated fund management) by parents, students and communities to promote a culture of care and respect for the physical infrastructure.

» The investment in improving Cali’s school infrastructure should be used as an opportunity to build capacity in the local design and construction sector in earthquake-resistant construction techniques.



7.0 Design Sprint Solutions

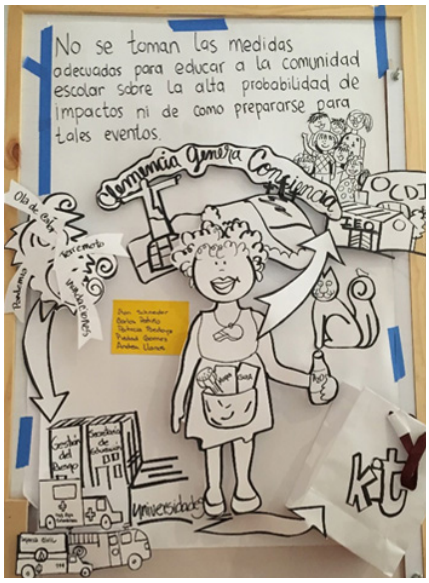
In addition to developing a set of best practices and recommendations for resilient school design and operations for Cali, participants engaged in a 'design sprint' to collaboratively build out nine 'solutions' for Cali on the topic of school infrastructure resilience which were presented to the Mayor of Cali, Maurice Armitage. Most of the solutions that were developed are elaborations of the recommendations included in the appendix, and there is considerable alignment and intersection across the solutions. Several of these projects are now being taken up by 100RC Platform Partners in collaboration with the city, particularly those focused on risk reduction to physical infrastructure:

1 **Risk Prioritization:** identify the schools with greatest risk for both acute shocks and chronic stresses and use this data to prioritize resources. Begin by conducting diagnostic research, then specify existing resources and funds that can be allocated to addressing the identified risk. Finally identify long-term funding to support implementation.

2 **A Protocol for Action:** consider schools as a system. Begin with mapping the entire school network, decide on priorities for interventions, develop a protocol for emergencies and create a fund and establish key partnerships in advance of a disaster.

3 **Resilient Schools Network:** a planning process to develop coherent actions for both risk mitigation and preparedness.

Vivian Argueta, Cali CRO, presenting design solutions to Mayor Armitage and local government officials



Presentation poster for the solution 'Clemencia genera Conciencia'

4 **Students Constructing Safe Schools:** a student-led master planning, visioning and hazard mitigation process for the Cali school system, starting first conducting vulnerability assessments on pre-1984 buildings followed by 1984-2010 buildings.

5 **Rapid Solutions for Resilient Schools:** implement quick, low-cost solutions (e.g. attaching bookcases and shelving to walls) to address critical non-structural seismic falling hazards in schools while longer-term mitigation programs and investment takes place.

6 **'Clemencia Genera Conciencia':** develop a 'kit' to educate students and communities on natural hazard risk and opportunities for preparedness.

7 **Community Integration:** Establish co-responsibility between communities and government for the implementation of resilient school infrastructure from design to construction to operation. Create a community-led steering committee to create a sense of ownership. Develop local coalitions to participate in the ongoing operations and maintenance of schools.

8 **Compulsory Training for School Contractors:** develop a certification program for local builders and require that all contractors who work on school infrastructure construction meet these certification requirements.

9 **Update Regulations to Reflect Local Needs and Resilience:** Embed resilience and create opportunities for greater flexibility in national zoning regulations to allow for appropriate local and site-specific approaches that emphasize quality of life and resilience. Establish a cycle of continual review and revision of regulations based on ongoing learnings to support progressive improvement.

8.0 Key Takeaways

There was agreement among participants that the CoLab was a constructive experience for local and international participants alike and that Cali has an extremely positive enabling environment to build the resilience of its school infrastructure, both in terms of risk reduction and creating greater opportunity for social, economic and environmental benefit. The following are three key takeaways that 100RC observed in speaking with participants about the workshop:

Takeaway 1 – A 'cross-pollination' of ideas

A benefit of the CoLab was that it created space for mutual learning between technical experts on disaster risk reduction and those with expertise in social science – education, community empowerment, recreation, economics. In doing so, the workshop influenced both sides' perspectives on the topic of school resilience to allow for more inclusive approaches with greater opportunity to identify co-benefits in projects and investments. Those who attended with a technical background in disaster risk management served a key role in helping to embed better risk mitigation into the city's existing program, while at the same time, they were asked to step out of this role and consider other critical factors related to community empowerment, environmental conservation and education. Equally, those with a social science background, including local participants, learned more about the importance of establishing a clear risk mitigation strategy as part of the city's investment program while also educating others on the realities on the ground of the educational system.

Takeaway 2 – Parallel paths of action related to DRM

With a topic and city initiative as complex and multi-disciplinary as school infrastructure resilience, it is necessary to pursue several parallel and related paths of action. In terms

of disaster risk management, the city's investment program must be informed by an evidence-based understanding of the vulnerability of its existing infrastructure. The objective of **risk mitigation** must underlie all decisions made related to school investment. In addition to mitigation, however, there are parallel opportunities that should be pursued. First, **risk education and emergency preparedness** for communities and students are important activities for governments to invest in to ensure that there is a clear understanding of the anticipated impacts of a likely disaster (despite ongoing mitigation efforts) and communities know how to respond. Second, **pre-disaster recovery planning** presents a remarkable opportunity for the local government, in concert with communities, to proactively plan for how they would recover if a disaster were to strike, and in doing so, reduce recovery times and leverage the disaster as an opportunity to enhance school safety and resilience. This requires establishing clear roles and responsibilities of key actors in advance, proactively addressing policies and procedures that could create roadblocks to resilient reconstruction, and pre-identifying opportunities to embed resilience and other improvements into anticipated reconstruction.

Takeaway 3 – Leverage Investments to Create Greater Social Value

A principle that was shared across the participants of the CoLab was the importance of schools as resources to the broader communities in which they are located and their role in promoting social cohesion. Rather than isolating school facilities from their surrounding neighborhoods, school design and programming should promote interaction (in a controlled way) between students and the community and provide much needed resources, such as libraries, internet access, performance and meeting spaces, gardens, playgrounds, emergency shelters etc. to communities. Investments in school infrastructure made to reduce risk should be evaluated with a 'resilience lens' to determine whether there are opportunities to enhance the resilience value of the projects to provide additional social benefits.

CoLab participants and the Mayor of Cali, Maurice Armitage, with school children from the John F Kennedy School

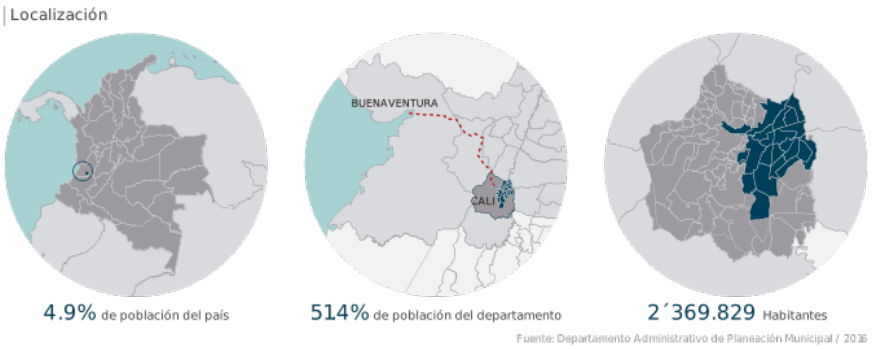
Appendix A

Information on Cali's My Community My School Program

I. Context of Cali

The Municipality of Santiago de Cali was founded on 25 July 1536 by order of Sebastian Belalcázar. Cali is the third largest city in Colombia after Bogota and Medellin, extends over an area of 564km^2 and is strategically located in proximity to the port of Buenaventura, the main Pacific.

Geographically Cali is in the upper valley of Cauca River between West Central Cordilleras and one of the areas of greatest seismic activity within the planet called Ring of Fire. Approximately 75% of the buildings in Cali were built before 1984, at which no standards for seismic resistance required infrastructure.



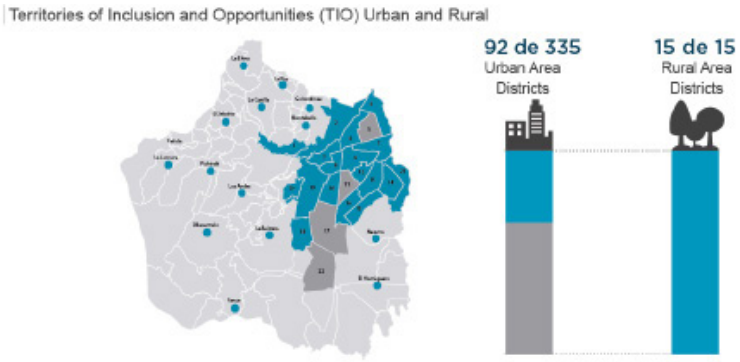
Cali is comprised of 22 urban communities and rural districts 15. There are 335 neighborhoods in urban communes representing 98% of the population of the municipality, and 84 rural villages comprising the remaining 2%.

According to the National Administrative Department of Statistics (DANE) 1'391.810 people of African descent living in Cali, the second city in Latin America after Salvador Bahia in Brazil, and the first in Colombia, with 12.7% of the Afro-Colombian population. The proximity of Cali with the Port of Buenaventura and the Pacific coast, expanding farming populations of northern Cauca, the then migration earthquake Tumaco in 1979, violence and the phenomenon of displacement, the search for better opportunities, among other factors, it caused many African came to town, bringing its cultural, culinary, artistic, musical and sporting wealth, which focuses on the preservation of the roots and customs, and vindication of rights.

Cali had been operating with a structure designed in 2000 due to a serious fiscal crisis facing the municipality, but it was updated in 2016 through administrative reform, which is given in order to update and prepare for a post-conflict scenario. Consequently, the municipality now consists of 24 bodies including 15 Secretariats 9 Administrative Departments, and 14 Decentralized Entities where the Health Networks, the Urban Renovation Company Emru, EMCALI, Metrocali, Corfecali, Special Housing Fund, among others. It is reform took effect from January 1, 2017 and is expected to this that the municipality more efficient by creating new ministries -economic development, Peace and Civic Culture, hire-restructuring existing secretariats and dependencies, having more clear and precise responsibilities.

On articulation is also important to emphasize the horizontal strategy, called territories cross social Inclusion and Opportunities (TIO), under which the team is Resiliency, which seeks to advance human development, strengthen the social fabric and increase participation and community empowerment of the most vulnerable areas of Cali.

The territories were prioritized by high homicide rates, infant mortality and malnutrition; high number of cases of dengue, Chikungunya and Zika; high dropout rates and unemployment; high number of victims of armed conflict and / or reintegration process; high percentage of people with insurance in the subsidized system (SISBEN), and low rates of coverage of sporting, cultural, educational and environmental equipment. To the date, OIT Strategy extends 92 of 335 urban districts of Cali (in 17 of the 22 Comunas) and the 15 districts of the rural area and is considered a model of inter articulation within the public administration, and between the public and private. By its results, TIO was institutionalized in the recent administrative reform and is now a Undersecretariat within the Ministry of Territorial Development and Citizen Participation.



In the municipality, according to the Department of City Planning, today, Cali's economy is characterized by economic development led by the commercial sector 30.2%, followed by manufacturing 18.8% and 10.5% real estate. The Chamber of Commerce of Cali has identified six clusters with high potential to grow and push the economic development of the region, which have been incorporated into a Cluster Platform including Bioenergy, Fashion System, Beauty and Personal Care Clinic, Excellence, Macro Snack and White Protein.

However, the unemployment rate in Cali (10.83%) is the highest among major cities in Colombia, although it has steadily declined in recent years. There is particular concern that youth unemployment rate reaches 34.1% in the districts 6, 13, 15, 18, 20 and 21 in greater concentration inhabited population called "nini" (Young that neither work nor study). When we look at the record communes more homicides tend to be the same districts 14, 15 and 20 suffering the highest unemployment rates. This lack of employment in addition to problems with the infrastructure of schools and colleges are the problems that touch the emotional chord to caleños, given that directly affect their well-being and quality of life.

II. Context of My Community, My School

The city of Cali seeks to consolidate itself as an inclusive municipality. A city that aims to be a leader and an innovator in the pursuit of welfare for its population, which in accordance with Colombia's National Development Plan (2014 - 2018), requires the closing of social gaps as part of a strategy to achieve social equity. Thus, the disparity in the quality of education represents a gap that must be closed in Cali. Therefore, the institutional effort is mainly oriented to the promotion of education that especially benefits the most vulnerable population.

Given the shortcomings of the educational sector of the Municipality of Santiago de Cali, the Municipal Government has decided to bet on the quality and relevance of public school curricula. This program will be financed through a combination of local resources, resources from the National Ministry of Education and loans. The execution of this initiative is carried out through investment projects that are directly executed by different Municipal Agencies all responding to the goals established in the Municipal Development Plan (Cali Progresa Contigo, 2016 - 2019).

The Municipal Department of Education (SEM) has 91 Educational Institutions with 342 educational centers that serve a total of 165,292 students, 8,674 in the rural area and 156,618 in the urban area. Currently, SEM calculates that in these institutions there is a deficit of investment of more than USD $ 760 million in critical aspects such as retaining walls, roofs, toilets, plumbing and electrical systems, dining rooms, enclosures and others. The institutions most affected by poor maintenance and other problems are usually found in the most vulnerable territories (TIO territories). Furthermore, there is also a problem owing to the lack of educational infrastructure in the most vulnerable territories affecting student quotas.

The Sub-Secretariat of Sectoral Planning of SEM, which manages the City's public educational infrastructure, has been making progress in adjusting educational centers in order to upkeep the existing infrastructure. However, there is still major work to be done as there are still between 80 and 100 educational centers with major structural failure that make it necessary to invest important resources to meet the needs of infrastructure and mitigate not only the immediate needs but avoid future contingencies.

In this sense, it is worth noting that most of public schools were built over 30 years ago without taking into account seismic standards and have not been adequately maintained, remodeled or modernized with the passing of years. Consequently, considerable amounts of schools do not comply with the recommended technical standards for educational infrastructure (NTC 4595, 4596 and 6199). Deficiency in school infrastructure naturally impacts the learning processes of schools.

III. Objectives

The main objective of the My Community, My School initiative is to improve the quality of Education and the Educational Relevance of the Municipality, with emphasis on TIO Territories, the most vulnerable territories of Cali.

IV. Executing Agencies

My Community, My School is executed through five municipal Departments: (1) The Department of Education, (2) the Department of Social Welfare, (3) the Department of Culture, (4) the Department of Sports and Recreation and the (5) Administrative Department of Information and Communications Technology.

V. Structure & Components

The Initiative will be executed through the following components:

1. Cali with Early Childhood Education
2. Cali with Dignified and Safe Schools
3. Cali with Educational Quality and Pertinence
4. School and Community
5. Cali with Educational Institutions Strengthened with Technology

Component 1: Cali with Early Education

This component seeks to strengthen the comprehensive offer of the Municipality for the population between 0 to 6 years. For this, it is intended to finance the construction and provision of Service Units (UDS), which are those instances where the early childhood population is attended in the Institutional and (8 hours a day from Monday to Friday) family modalities (1 educational meeting, 4 hours a week with caregivers), and others, in the territories with insufficient coverage.

In addition, in terms of Quality of the Education, this component will focus on the implementation of MAS+ a pedagogical accompaniment model created by the Ministry of Education (MEN). It will also focus on piloting a quantitative and qualitative evaluation tool of the quality of education imparted in early childhood centers. Cali will be the first city in Colombia to carry out this evaluation.

Component 2: Cali with Dignified and Safe Schools

This component seeks to counteract the deficit in investment, maintenance, adjustment and reconstruction of the public educational infrastructure of Cali and to increase the number of quotas in the territories where there is insufficient coverage. Therefore, it is intended to finance the construction, replacement, adaptation, repair and/or maintenance of educational infrastructure (see details below).

Component 3 Cali with Educational Quality and Pertinence and Component 4 School and Community

The objective of components 3 and 4 is to contribute to improving the quality of education in the Municipality, understanding that the quality and relevance of education contribute to the learning process, a peaceful coexistence, and guarantee a better quality of life.

To respond to this objective and find ways to respond comprehensively to the problems associated with the quality of education in the municipality, components 3 and 4 were designed that focus on a Comprehensive Accompaniment Strategy for Educational Institutions. The same part of three fundamental premises:

1. The center of the strategy are the children and young people of the municipality, support the construction of their life projects from the school, improve their learning and strengthen their skills looking for them to be participatory citizens.

2. If the Municipality aims that children and young people improve their learning and life skills, healthy coexistence and the sense of education in their life projects, conditions must be given from and within the educational institution as a whole (with its actors, its context and its dynamics).

3. To create or strengthen these conditions, it must accompany the educational institutions in their daily management, from the instruments that naturally accompany them, and understanding, reflecting and building with their actors strategies that allow them to advance.

Component 5: Cali with Educational Institutions Strengthened with Technology

This component aims at the implementation of technological systems throughout the public school system to contribute to the quality of education and the integral management of schools.

Component 2: Cali with Dignified and Safe Schools - Detailed

This CoLab will primarily focus on the activities developed under Component 2 through which the educational Infrastructure of the City will be intervened. The following table shows the different kinds of activities that will be developed under this component:

34 Educational Centers (Rebuilt) BP 02047302	7 Educational Centers (New) BP 02047306	7 Early Childhood Development Centers BP 02047304	100 Educational Centers (Adjustment) BP 02040128	Strengthening ICT in 342 Educational Centers BP 02047316
Law 21 – 27 5 Ongoing 10 in process of licensing 12 in process of feasibility Own Educational Centers – 5 4 Ongoing 1 in process of licensing	C13- Jesús Villafañe C15- Llano Verde C18- San Gabriel** C18- José María Cabal** C21- Potrero Grande C21- Vallegrande C53- Pichindé	C1- La Balastrera C13- Pondaje C15- Llanoverde C15- Calida C20- Jaime Rentería C21- Vallegrande	2017 16 Educational Centers 2018-1 34 Educational Centers 2018-2 50 Educational Centers	342 Electrical Adjustment 342 Access to Cloud

Ongoing
Process of licensing/feasibility
** acquired

The first type of intervention, 32 Reconstructed Centers, refers to situations in which there will be total or partial demolition of educational centers in order to reconstruct them in conformity to NTC 4595 and 4596. It is worth mentioning that in some instances the educational center will still have old classroom blocks within the same school grounds.

The second type of intervention, 6 New Schools, refers to two purchases of previously private schools that will now serve as part of the public school system, and the construction of 4 new schools that will not only conform to the NTC 4595 & 4596 norms, but also the Guidance from the Ministry of Education on Model School Design. All of the infrastructure will conform to seismic regulations and the new Territorial Development Plan (POT) of Cali. Of the 6 new schools, two have already been purchased, three have been procured and are in the final design stages (Colegio Potrerograde District 21 y Colegio Llano Verde District 15, Colegio Vallegrande C21). One school, located in the rural territory of Pichindé, is still being structured for public bidding. The site for the location of this school will be part of Tuesday's Living Lab.

The third kind of intervention, 7 CDIs refers to the process of completing and constructing Early Childhood Development Centers for the population 0-6 years old. Of the 7 CDIs, 3 are in the process of being completed thereby being fully designed and in implementation. Four are new constructions, only one of which has been procured and is currently being designed (CDI Vallegrande in District 21). The remaining three are currently being structured for public bidding. One of these (CDI Jaime Rentería Cuna de Campeones in District 20) will be designed through an architectural contest which is currently underway.

The fourth type of intervention, Adjustment of 100 Schools, focuses on the adjustment of 100 School Center on a variety of aspects ranging from containment walls to the replacement of lavatories and electrical infrastructure. These interventions are clearly not of the same magnitude of the first three described above and they do not require construction licenses. Nonetheless, these can be useful vehicles through which critical resilience and sustainability aspects can be incorporated into educational infrastructure. To date, 16 adjustments have been carried out in 16 schools. Currently, two bids are being structured for the second group of 34 schools with infrastructure adjustments and the third group with 51 adjustments.

Finally, the fifth type of intervention, ITC strengthening of 342 Centers, refers to all those activities that will be carried out to ensure the totality of schools are connected to the cloud for the development of pedagogical activities.

Relationship to Cali's Resilience Strategy

In 2015 Cali was selected to be part of 100RC and 2016 Cali was formally invited to join the network. The administration of Mayor Armitage began the process of building a Cali Resilient in June 2016 with the launch workshop Program "Towards an Agenda for Cali Resilience" which was attended by guests from stakeholders in the public, private sector and civil society to identify the main challenges for the city in this area. Since then, the team Resiliency City, part of the Secretariat for inclusion Territories and Urban Rural Opportunities, has worked with 100RC to comply with the methodology established for each city.

100RC methodology is divided into three main phases: (I) the evaluation phase, (II) the design stage and develop a strategy, and (III) the implementation phase. During Phase I, which was completed in April 2017, a Preliminary Resilience Assessment or PRA was carried out in Cali. This assessment was the result of a research process, stakeholder engagement, evaluation of perceptions, actions and infrastructure, with regards to the City's state of Resilience. The PRA identified Cali's weaknesses and strengths in terms of resilience. The results of the PRA showed Cali has strategic weaknesses in resilience in terms of (1) security, civic and peace culture, (2) education, (3) mobility and (4) planning, coordination and data management. On the other hand, the city strengths included (1) the commitment of the Municipal Administration to boost income generation and development of the local economy, (2) information technology and communication (ICT), (3) risk management and (4) satisfaction of basic needs.

As part of the process to counteract the weakness in Education identified, the Resilience Office partnered with the Municipal Education Department to launch the creation of the My School, My Community Program described above. Furthermore, it is worth noting that as part of Cali's Resilience Strategy to be launched in May 2018, the city will focus on long term strategic goals such as the creation of a a short, medium and long term construction and retrofitting plan, an asset management plan and the formulation of process and result indicators for educational infrastructure. Likewise, with regard to the Quality of Education, the city is constructing an ambitious short, medium and long term model to transform learning in public schools.

To provide additional context, the following section contains excerpts of the PRA with regard to Education.

Excerpts of Cali's Preliminary Resilience Assessment (PRA)

Education.

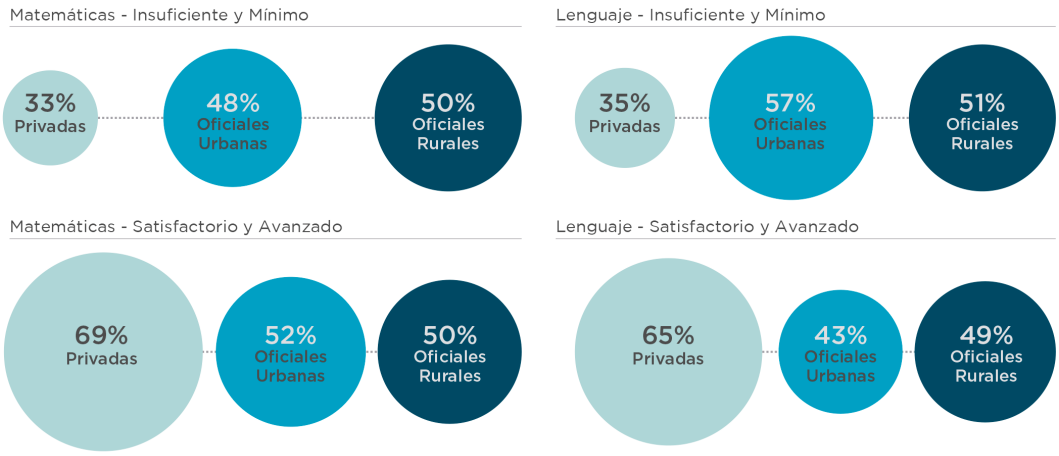
Perceptions and Current Status. In education, the results of the tool perception match the Socioeconomic Diagnosis of Cali, as to the great challenges in terms of relevance of the type of education offered. In this sense, first it highlighted the apparent lack of coordination between the supply of formal and technical education, and the needs of the productive sector. Second, the lack of coordination between the challenges of peace, coexistence and development of socio-emotional skills facing the city-and beyond, all Colombia- curricular approach in official educational institutions. While the former is perceived as an element affecting the competitiveness of the city, the second is identified as a strategic weakness that directly affects the ability of Cali to peacefully co-exist.

The education system, which shares responsibility for promoting the development of better citizens, is challenged by the need to develop peace, coexistence and socio-emotional skills of the younger population of the city. This need is highlighted by the results of the measurement of Citizen Culture Index 2016, which revealed that the indicator of coexistence and diversity in Cali has worsened in relation to the 2013 Index and is related to the animosity existing among neighbors from different backgrounds (intolerance). Complementing the insights mentioned in the Security, Civic Culture and Peace Section, this intolerance, is constantly begetting more violence and insecurity in neighborhoods and must be replaced by tolerance and coexistence which must be fostered at the school level.

Regarding data management, the Ministry of Education of Colombia administers the SABER standardized tests that are annually conducted among students in third, fifth, ninth, and eleventh grades, with the goal of contributing to improving the quality of education and monitoring the development of the student population. The Ministry shares the results of the tests with educational institutions and the Municipal Department of Education for the reorientation of teaching guidelines accordingly. The Municipal Department of Education also monitors the status of the educational infrastructure and student attendance, among others. The Ministry of Education also provides detailed information on school attendance to the national program of conditional cash transfers, Familias in Accion, to help evaluate how families are receiving financial support to ensure the healthy development and permanence of their children in the school system. Even so, educational data is limited and not updated, creating a big problem for informed decision making both in terms of the quality of education and educational infrastructure.

With regard to the quality of education, the study of Cali Cómo Vamos shows the contrast in the performance between private and public schools where the Saber 3 standardized tests were applied. While 50% of students tested in official institutions received inadequate or insufficient scores only 34% of private schools received similar grades. These results not only show the great inequality between the public and the private system, but emphasize the social divide between Cali's poorer population that primarily attends public schools and the City's middle and higher class which favours private education.

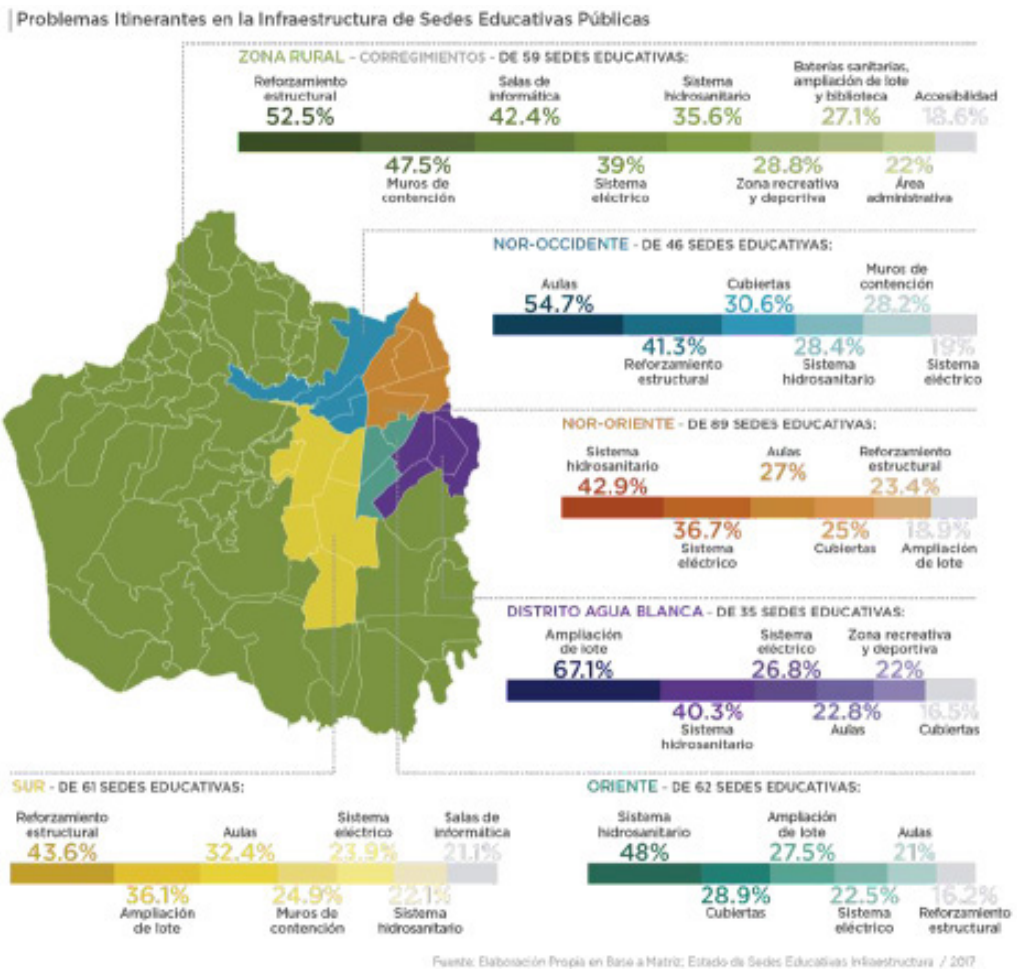
Calificaciones de Instituciones Educativas de Cali en las Pruebas Saber 3



Fuente: Cali como vamos / 2015

Educational infrastructure. Apart from the aforementioned weaknesses, education in Cali suffers from deterioration and lack of educational infrastructure. According to the results of the Asset and Risk Tool, four of the five infrastructure components classified as vulnerable in the city are related to educational and cultural infrastructure. Cali's Socioeconomic Diagnosis also emphasized the results of the tool mentioning that the main problems identified by community leaders affecting education are poorly maintained and inadequate educational infrastructures. The Municipal Department of Education estimates that of the 342 educational centers managed by the municipality, most require repairs of the hidro-sanitary systems, require structural reinforcement, and partially or completely fail to comply with NSR 10 (seismic regulation) and national technical standards NTC 4595, among other needs. The Secretariat also estimates that if the current trends continue, over the next few years, 11 of the 22 communes and rural areas will suffer from a shortage of school infrastructure, clearly demonstrating the need to expand coverage.

Actions. Cali weaknesses in education are ample and urgent. For this reason, Mayor Armitage created an ambitious USD 170 million dollar program called My Community, My School, which seeks to improve the quality and pertinence of Cali's public educational system, prioritizing the territories that are part of the Strategy for Inclusion and Opportunities (TIO). The program has five different components that focus on (1) strengthening the supply of early childhood education (education of children aged 0 to 6 years), (2)



adjusting and repairing education infrastructure, (3) improving the quality of education, (4) developing the emotional skills of children, and (5) strengthening institutions through ICT tools. It is important to note that the component four, which develops emotional skills of children, aims at supporting the development of a civic culture that promotes peace, tolerance and safety. It should also be noted that improving the quality of education is improving the human capital of the city, which boosts economic growth and help reduce unemployment. This program is currently in its preparatory stages and would greatly benefit from the strategic support of both quality of education and infrastructure experts.

Living Lab Description
Tuesday, February 20th 2018

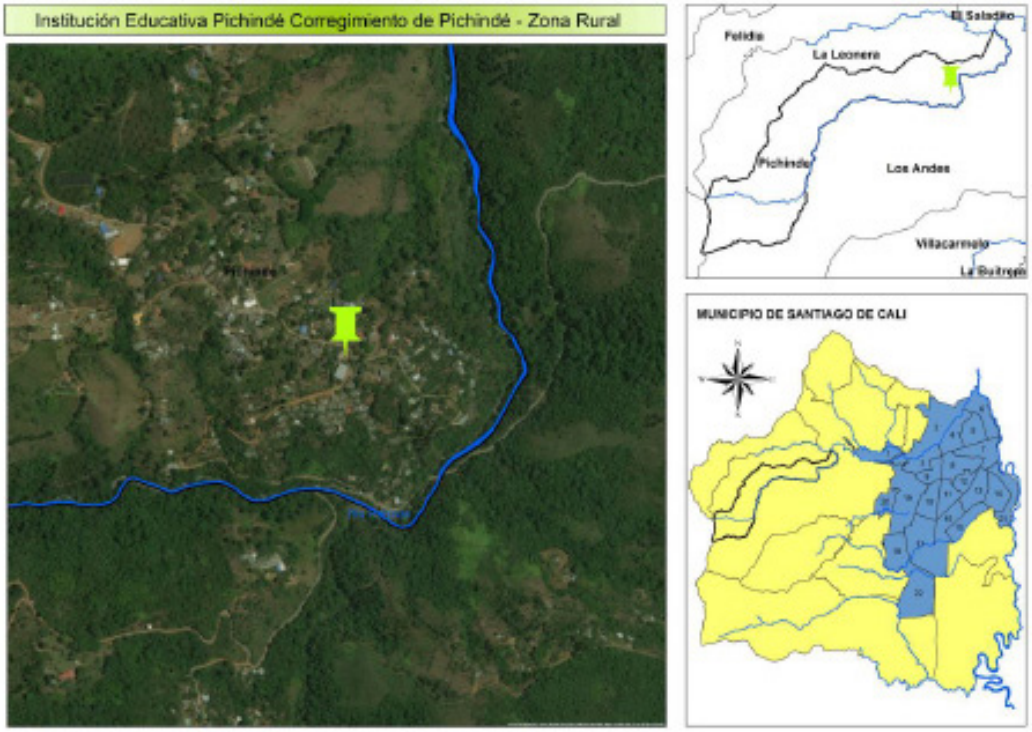
Introduction

During the Living Lab we will be visiting two public schools in Cali, both located in the vulnerable territories that are part of the TIO Territories. One of these institutions is located in the urban zone of Cali (John F. Kennedy) and the other is located in the rural area (IEO Inmaculada Concepción). We will also visit an Early Childhood Development Center (CDI) where the population 0-6 years old receives integral care.

Agenda

Departure	Arrival	Territory	Institution
12:15	13:15	Pichindé - Rural Area	Site where new school will be constructed
14:15	15:00	District 18	John F. Kennedy School
15:45	16:15	District 18	Early Childhood Development Center Altos de Santa Elena

1. Educational Institution La Inmaculada Concepción, Pichindé - Rural Zone



New School

The first visit will be to the terrain destined for the construction of the Educational Institution La Inmaculada Concepción. It is located in the rural area of Pichindé, a zone that is part of the TIO territories, the most vulnerable territories of Cali due to its socio-economic indicators.

The Educational Institution La Inmaculada Concepción belongs to the Pichindé Educational Institution. The terrain of the school was donated in 1950 but the school did not start its operation until 1956. Since its beginning, it has served an approximate population of 200 students (all of the rural area). The school served the male population in a facility called Sergio Cantillo and the female population at the Educational Institution La Inmaculada Concepción. Eventually, the Sergio Cantillo Educational moved to the Immaculate Conception, causing the loss of coverage. This problem was solved later when the teachers of the sector decided, in accordance with the community, to move again to the Educational Institution Sergio Cantillo.

In 2005, the Pichindé Educational Institution was officially created, consisting of three venues: Sergio Cantillo, La Inmaculada Concepción and José Holguín Garcés (main Educational Institution). It is worth mentioning that all this time, the Educational Institution La Inmaculada Concepción operated in a rented property. In December 2016 the property was returned to the owners leaving the institution without a place to operate since then. For this reason, in 2017, the Municipal Education Department bought an adjacent property

to the educational center Sergio Cantillo with an area of 12,000m2 for USD $ 228,000 to build its own educational institution for La Inmaculada Concepción. This work is part of the construction of new schools of the initiative My Community, My School under component 2.

Work Program

The Educational Institution offers the following academic programs in its three locations:

- Early childhood, preschool (Daytime)
- Basic primary, first to fifth grade (Daytime)
- Technical media, offered in agreement with the EI CASD (Daytime Workshop)
- Adult literacy and education programs (Night)

In the lot, there is an existing building that does not comply with the necessary regulations to work as a classroom. The construction project of the Educational Institution includes the recovery of this building. Figure 1 below shows the topography of the land.

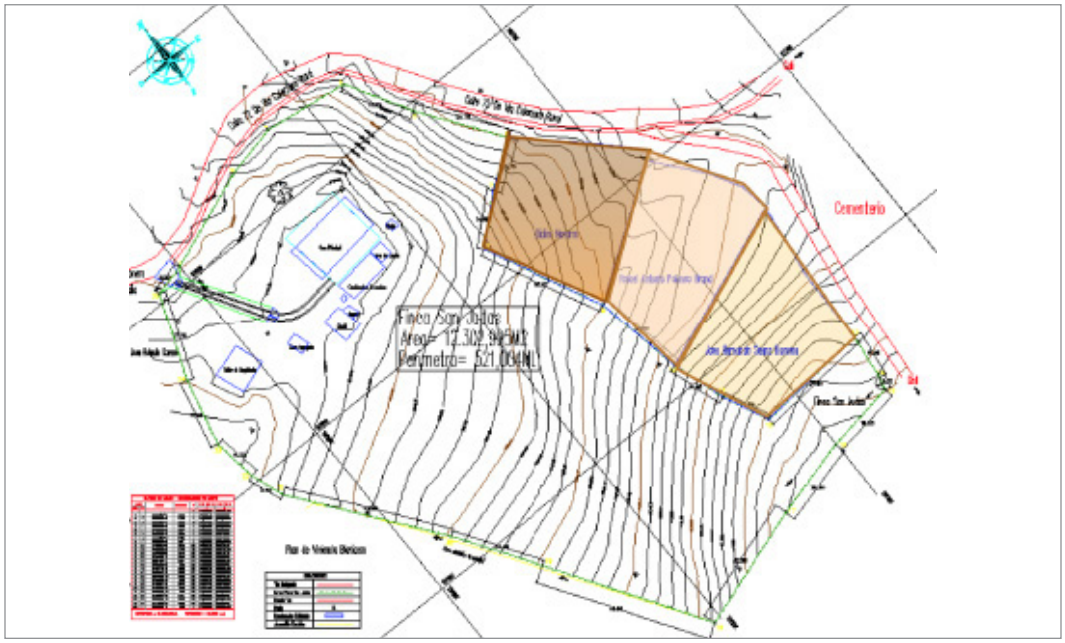


Figure 1

Figures 2 and 3 below show the proposed implementation and zoning of the property according to the regulations required for this school.

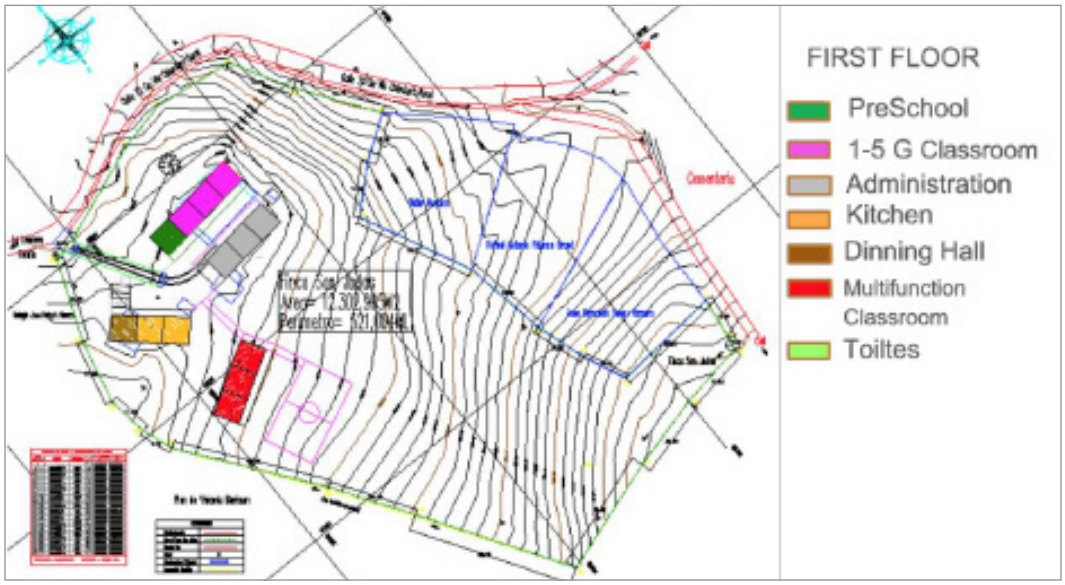


Figure 2

It is important to bear in mind that the expected enrollment for the institution is 300 children. However, it is possible that because this institution will be a practically new, it will attract the students of the two neighboring locations (Sergio Cantillo and José Holguín Garcés). In addition, it is expected that in the flat land of the terrain, where there will be no building, the orchards, productive projects and other central elements will be developed to the curriculum of a rural educational institution.

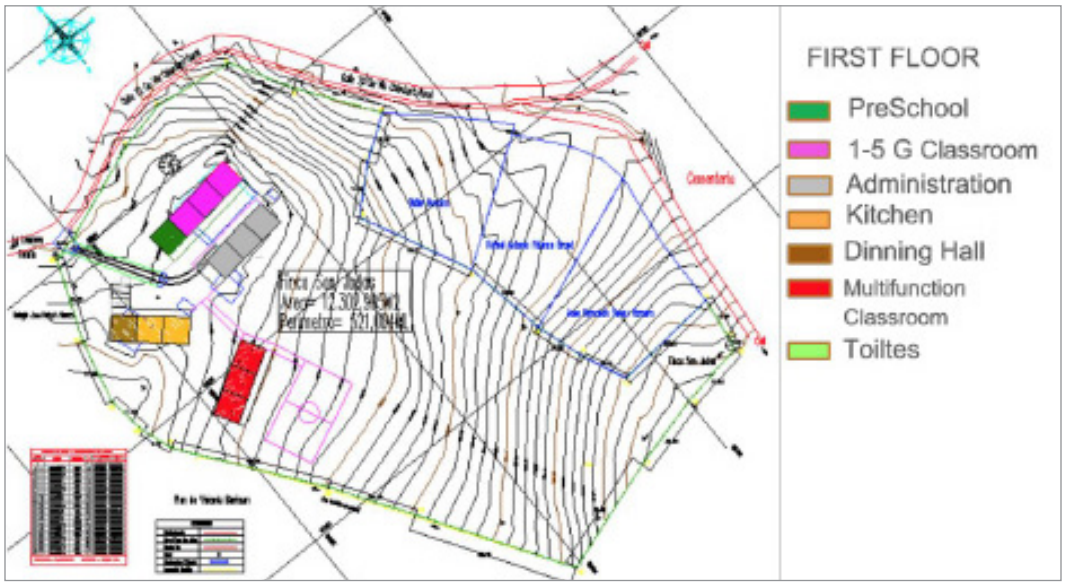
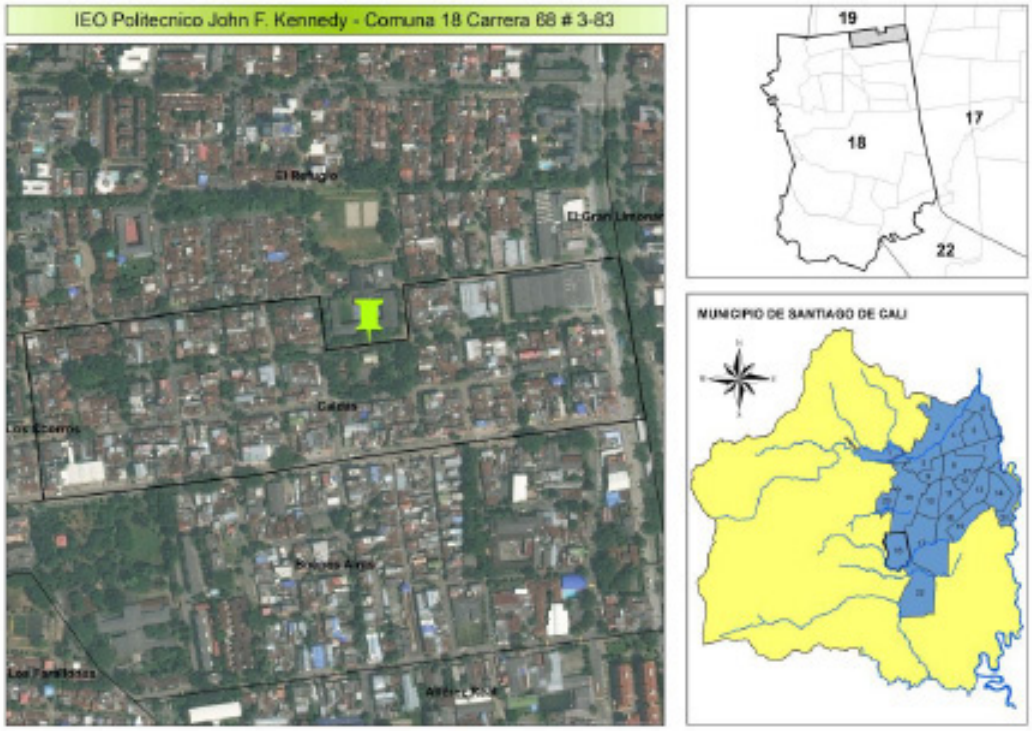


Figure 3

It will be explained in greater detail the scheme of implementation and zoning of the lot and the context of the Educational Institution during the visit.

2. Educational Institution John F. Kennedy, Urban Zone



The Educational Institution Politecnico Municipal de Cali was created by the City Council Agreement No. 8550 of September 2nd, 1957 under the administration of the Mayor Dr. Carlos Garcés Córdoba, who appointed Dr. Josué Ángel Maya as the first Principal. He began his work at that time with 287 students.

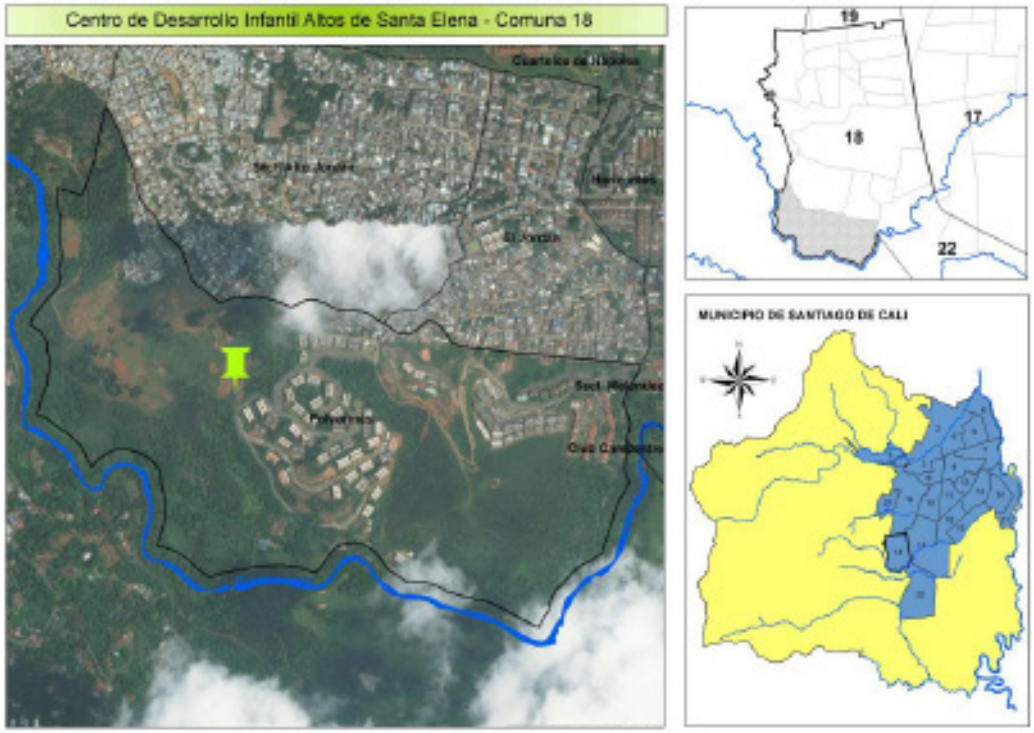
On May 30th, 1962, the Government of the United States through its Alianza para el Progreso program, in agreement with its counterpart from Colombia, delivered the physical plant of the school that would bear the name of the president of the United States at that time: John F. Kennedy.

The facility includes 3 one-level blocks, built in a concrete frame system with cement tile roofs supported on metal trusses. This type of construction is representative of 65% out of the total buildings present in the educational institutions of the city of Santiago de Cali, which were built between the 60's and 70's. These structures have not been upgraded in accordance with the Seismic Construction Regulation in Colombia (NSR-10) or with construction parameters of the Colombian Technical Standard NTC 4595 of 2006.

As response to the need to expand the coverage of the school, a two-level structure was built on 2008, designed in accordance with the regulations at that moment. The structure is based on a concrete frame system.

At present, the Educational Institution offers the academic programs of Early Childhood (preschool) and Basic Primary (first to fifth) divided in two types (morning and afternoon), with a total of 594 enrolled students.

3. Early Childhood Development Center - Altos de Santa Elena, Urban Zone



The Early Childhood Development Center Altos de Santa Elena is located in the 18th district on the hillside of Cali. It was inaugurated in 2015 within the framework of the TIO Strategy. Its infrastructure is distributed in two floors that includes educational areas, classrooms, bathrooms and storage spaces, as well as complementary services such as kitchen, multiple classroom, administration, nursing, sanitary batteries, as well as large areas of circulation, parking and recreation all in compliance with the National Standard NTC 6199 of Comprehensive Early Childhood Care.

Currently, the Early Childhood Development Center serves a total of 300 girls and boys (maximum quota) with comprehensive care (8 hours a day from Monday to Friday) and pregnant and lactating mothers in family mode (1 weekly educational meeting of 4 hours with caregivers).

In the family modality, attention is directed to pregnant women, lactating women, children under 5 years of age or until they enter kindergarten. Support is given to families and caregivers that require support to strengthen their care and upbringing processes at home, but that they cannot have their children in an Early Childhood Development Center daily. Therefore, the family modality seeks to strengthen the affective bond of children with their families, prioritizing access for children under 2 years of age. They are developed through training and accompaniment processes for families and caregivers, with the purpose of strengthening their skills of care, nurturing and joint construction of tools for the harmonic and integral promotion of development in weekly sessions of 4 hours.

For integral attention, the Early Childhood Development Center has a nursery, 6 educational environments for boys and girls from 24 to 36 months of age, and 8 educational environments for boys and girls from 37 to 60 months of age, each one with its own bathrooms and space for storage. For the family modality, the Early Childhood Development Center has a multipurpose room, warehouses for food, a kitchen and its own bathrooms.

This project had an investment of approximately USD $ 1.8 million and has a built infrastructure of 1,927 square meters. Its construction and provision was due to an alliance between the public and private sectors and international cooperation, with resources from the Club Campestre Foundation of Cali and the Embassy of the People's Republic of China in Colombia, among others. The operation of this center is outsourced with the Fe y Alegría Foundation, but it is co-financed with resources from the Cali Mayor's Office and the Colombian Family Welfare Institute (ICBF), an entity that is responsible for early childhood care at the national level.

Appendix B

Problem Tree for School Infrastructure Resilience

OVERALL PROBLEM STATEMENT:

Schools and support infrastructure are inadequate, poorly designed and vulnerable to natural and man-made hazards, exposing children to significant risks that they are unprepared to face and impacting the broader resilience of communities.

PROBLEM COMPONENT #1:
New school construction and renovations of existing schools do not effectively reduce risk and build community resilience.

Topic Area	Root Problems
Centralized vs Decentralized Approaches	Mandate for school construction typically at national level, creating a disconnect with users of infrastructure at community level
	Standards are inflexible and not adaptable to specific local contexts and needs
Risk Awareness	Lack of knowledge of risk
	Lack of access to key information for decision making (ie risk maps)
	Lack of collective memory regarding magnitude of risk
Design	Structural/civil design of facilities is not adequate
	Inappropriate building codes for local context
	Life-safety standards vs operational standards
	Lack of code enforcement, construction quality control
	Architectural/landscape design of facilities is not adequate
	Lack of community participation/ownership in design process
	Siloed thinking in design
	Lack of mandate (from client) for design team to think bigger/more creatively (procurement)
	Lack of accessibility in design / poor topography
	Schools are fenced off/closed off from rest of community
	Lack of methodology to reduce risk through specialized design
O+M	Ongoing maintenance, renovations and additional increase vulnerability of schools (disconnect between original design and future modifications)
	Designs do not consider future maintenance costs
	Lack of training for maintenance staff
	Lack of inclusion of students/families in O+M of schools – lack of ownership by the community in school upkeep
	Lack of financial resources for maintenance

Building Regulations	Inflexibility of standards
	Lack of integrated urban planning
	Process to understand and apply standards is complex and bureaucratic
Legal	Legalization of properties (possession – green areas are not included in the deed)
Construction Materials, Supply Chains, Labor	Restriction of use of local materials and vernacular construction methods in rural areas
	Use of inappropriate materials for the sector
	Not locally/easily available
	Not durable
	Not appropriate for local environmental conditions
	Lack of quality control of building materials
	Lack of training in labor and construction guidelines for more smaller-size projects/buildings
Funding	Insufficient budget for school infrastructure
	Insufficient budget for school maintenance
	Value engineering in design reduces resilience and resilience-building opportunities
Community Integration	Lack of consideration of relationship between school and surrounding community
	How community supports school (eg road safety)
	How school supports community (eg emergency shelters)
	Lack of citizen participation in the planning and design processes for schools – not all stakeholders are heard
	Lack of a culture of shared use

OVERALL PROBLEM STATEMENT:

Schools and support infrastructure are inadequate, poorly designed and vulnerable to natural and man-made hazards, exposing children to significant risks that they are unprepared to face and impacting the broader resilience of communities.

PROBLEM COMPONENT #2:
When a disaster does strike, governments do not use the opportunity to build back more resilient school infrastructure.

Topic Area	Root Problems
Centralized vs Decentralized Approaches	Centralized rather than decentralized approaches are frequently taken during reconstruction due to politics and time pressure Requirements for spending of funds from donor organizations Political pressure to open schools Shortage of trained, qualified contractors at local level to support reconstruction Facilities are built using inappropriate, non-local materials whose ongoing maintenance and inspection cannot be supported at local level for full lifecycle of the asset Lack of centralized aid resources
Design	Schools are rebuilt with generic, cookie-cutter design for sake of efficiency – lack of diagnostics of the conditions in the sector where the school is located There are no set parameters to determine priority of interventions
Building Regulations	Existing regulatory system that is in place does not support building back better (both codes and enforcement) and would require significant time, effort and funding to modify Lack of local research available to modify/adapt a standard to local context Unclear ownership and responsibility for mitigating risk and planning for recovery
Construction Materials, Supply Chains, Labor	Unskilled labor, builders not trained in hazard-resistant techniques Corruption as it relates to materials standards and certificates (lack of pre-certified contractors)

Funding	Efforts and funds focused on construction of temporary facilities following a disaster rather than permanent facilities
	Preparing for big/rare events does not seem to make economic sense
	Lack of forecasting of financial resources that would be needed in an emergency taking into account diagnostic of local conditions/risk
	Lack of money set aside for disasters besides contingency
	Corruption takes advantage of emergencies to divert economic resources so that they do not help the affected populations
Community Integration	Lack of communication
	Community not included in the development of plans and solutions
	Informality and lack of data - the number of people affected by a disaster is not registered. People who are not recorded do not receive benefits.
Politics and Human Behavior	Schools are sometimes rebuilt in the same vulnerable locations due to political challenges of relocation
	Governments do not take measures to prepare in advance for eventual disasters (pre-disaster recovery planning) in ways that would mitigate these root problems
	Sentiment that disaster will never happen
	Lack of awareness of risk
	Existing deficient/vulnerable/damaged schools are sometimes re-occupied temporarily (and ultimately permanently)
	Lack of building re-occupancy program to identify buildings that should not be re-occupied
	Incorrect notion that if a building wasn't damaged in one event, it is safe
	Reactionary mindset – the hazard is not a priority until after it happens
	Political interests - pressure to show results, recover quickly and put schools back in operation
	Corruption
	Policies are imported and not adapted to local context
	Thinking that we have rights but no duties. We do not meet standards, we believe to be above them or that they do not apply to us.
Partner Organizations and Communication	Well-intentioned NGO's decide to build schools with little experience or awareness of real risks and opportunities and little coordination amongst them
	Institutions do not have the capacity or are not ready to execute on established priorities and use recovery $ that becomes available (this can lead to a reduction of funds received as well)
	There are no systems for quick inspection of damaged buildings and prioritization to maximize speed of re-occupation
	Lack of connection across city departments for pre-disaster recovery planning
	Too many state entities handling response which makes it very bureaucratic
	Post-disaster recovery requires new modes of working together across organizations that have never been tested before

OVERALL PROBLEM STATEMENT:

Schools and support infrastructure are inadequate, poorly designed and vulnerable to natural and man-made hazards, exposing children to significant risks that they are unprepared to face and impacting the broader resilience of communities.

PROBLEM COMPONENT #3:
Schools do not take appropriate measures to educate occupants of the facilities and associated communities about the likely impacts of shocks and prepare them for these events.

Topic Area	Root Problems
Centralized vs Decentralized Approaches	Typical centralized approach to educational infrastructure does not favor empowerment of local communities Response time is longer where centralized approaches are used Standards are available, but work needs to be done in transferring information to the community National, provincial and local levels must all be involved and integrated. When they are not, it is not clear who can do what.
Risk Awareness	Lack of awareness of risk / lack of systemic thinking We believe it will never happen / overconfidence Lack of a culture of prevention from childhood Lack of citizen awareness in standard compliance as a protection measure Science and engineering leads to an understanding of the problem but is not always translated into action (ie policy and solutions) Technocrats, educators and communications teams are not connected and working together
Design	Lack of technical, cost-effective tools for assessment of risk, vulnerability and damage; design of viable solutions; quick and effective implementation post-disaster Where schools are designed to be used as emergency shelters, there can be a lack of awareness on the part of staff and users of the impacts that this emergency function may have on the functionality of the school Lack of addressing non-structural falling hazards in schools (eg attaching bookcases to walls) Lack of supplementary means of protecting students who must go to school in vulnerable buildings – if a building is unsafe and has not been retrofitted, are there quick/cheap/easy techniques to reduce vulnerability short of a full building retrofit?
Construction materials, Supply Chains, Labor	Communities are not involved in learning about hazard-resistant building techniques that align with local materials and construction methods

Funding	Lack of funding for emergency preparedness programs
	Sentiment that disaster will never happen
	Not within budget priorities
	Benefits of educating and preventing are not understood
Community Integration	Schools are not intentionally leveraged as emergency shelters in times of crisis
	Other existing community infrastructure (eg telecommunications) is insufficient to support appropriate preparedness approaches
	Communities lack risk management and disaster response plans (routes of action, meeting points, signaling, emergency brigades, contact with relief agencies)
	Lack of community participation in identifying risks and vulnerabilities, designing solutions and managing interventions
	Lack of community engagement in immediate response efforts – individual interest is more important than general interest
	Distrust of authorities / lack of respect for authorities
Politics and Human Behavior	Complex family/living situations means messaging in schools does not necessarily make it back to parents (and vice-versa)
	Some people may appropriate educational facilities and prevent the resumption of educational activities. The community takes 'refuge' and does not take ownership of the reconstruction of the facility.
	Lack of reflection / learning from the past: what happened? Why did buildings fail? How to improve construction?
	Hard to prioritize low frequency, 'long tail' events – people are more focused on solving pressing issues – how to address risk of infrequent events and everyday needs at the same time?
Partner Organizations and Communications	Lack of materials and compelling campaigns that inform about existing risks
	Lack of alarm systems / early warning systems
	Local technical professional community may not have capacity (lack of training and/or practical experience working together)

Appendix C

Recommendations for School Infrastructure Resilience

RECOMMENDATIONS FOR SCHOOL INFRASTRUCTURE RESILIENCE

Cali, Colombia – February 2018

Introduction

This document provides a set of recommendations to the City of Cali, Colombia on improving the resilience of its school infrastructure. These recommendations are the outcome from a group exercise which took place during a 'CoLab' collaborative workshop hosted by 100 Resilient Cities (100RC) in Cali, Colombia in February 2018. Participants included City of Cali officials and administrators, 100RC Partners and Subject-Matter Advisors, and 100RC Staff.

The recommendations are organized into three categories related to school infrastructure:

- Design-related recommendations, i.e. considerations for the planning and design phases of school infrastructure projects
- Operations-related recommendations, i.e. considerations for the operation and maintenance of schools and associated programs, some of which may also influence the design of the facilities
- Systems connections and related recommendations, i.e. considerations related to programs and opportunities that could be explored as parallel initiatives outside of the scope of a school infrastructure project

For each recommendation, participants listed 'inspirations' including precedents from other cities, case studies, and related resources where more information can be found. These references are provided in the tables below as well as other references that were identified through desktop research following the CoLab.

What is resilient infrastructure?

Resilient infrastructure is infrastructure that can not only withstand or quickly recover from dynamic and changing shocks and stresses but also provide social, economic and environmental dividends to cities beyond its basic functions.

The following questions can be considered when assessing, developing programs to promote or investing in infrastructure resilience:

Is the physical asset resilient?

- Consider multiple, dynamic hazards and anticipate long-term needs related to the shocks and stresses the asset is likely to face
- Plan for what could go wrong and how the asset will either keep functioning or recover quickly based on redundancies in design and operations

» Build in flexibility so the asset can respond to changing demographics and needs over the course of its useful life

Does the project provide benefits to its users and the community in which it is located?

» Consider both short and long-term impacts of the project on its users, beneficiaries and stakeholders including secondary 'co-benefits' or 'dividends' generated from the project that may fall outside the immediate objectives of the project but contribute to community or systemic resilience

» Identify, maximize and support these 'co-benefits' throughout the full lifecycle of the asset, including design and operations

How does the project connect to and benefit systems outside of the project scope?

» Minimize risk and maximize opportunity for the project based on an understanding of the project's connection to city-wide, regional, national and/or global systems, including interdependencies across social, environmental, economic, institutional and built-environment systems and networks that fall outside the project scope

A - Design-Related Recommendations

A.1 DISASTER RISK MANAGEMENT

#	Recommendation	Related References and Case Studies	Related Shocks / Stresses
A.1.1	All schools (new and existing) should have sufficient seismic, wind and flood resistance to remain 'life safe' or 'operational' during a catastrophic event. Conduct a vulnerability assessment of the city's school infrastructure portfolio (starting with pre-1984 buildings, followed by 1985-2010 buildings) and identify those schools which are most vulnerable to earthquakes and floods. Use this information to prioritize retrofits and new construction through a long-term mitigation plan. Use a system-of-systems or network approach to allocate limited resources to retrofit and build new schools for multi-hazards. For example, consider upgrading a portion of schools to a 'life-safety' performance level, including the use of 'common sense' and 'pre-engineered' upgrades. Consider which facilities need to be upgraded to an 'operational' performance level to serve as emergency facilities and/or temporary schools for additional students in the event of a disaster. Engage communities in this process.	World Bank Roadmap for Safer Schools Design Guide for Improving School Safety in Earthquakes, Floods and High Winds (FEMA 424) Incremental Seismic Rehabilitation of School Buildings (FEMA 395) Unreinforced Masonry Buildings and Earthquakes (FEMA P-774, pg 34-36) Resilient Schools Through Leadership and Community Engagement See other attached references	Flooding, earthquake, severe storms
A.1.2	Site new schools to minimize hazard exposure in order to reduce the engineering and construction costs that would be necessary to mitigate the risk. Avoid high flood areas, high landslide areas, areas with high susceptibility to liquefaction, lateral spreading and fault rupture.		Flooding, earthquake, landslides, liquefaction
A.1.3	In order to site schools to minimize hazard exposure, it is important to understand site variability and landscape in a city and to review the history of each site considered to determine: What are the soil characteristics? What is the ground water level? Was the site filled in the past with organic material which could make it susceptible to seismic amplification like in Mexico City? Is it located next to a river or creeks which could make it susceptible to flooding or liquefaction?		Flooding, earthquake, landslides, liquefaction
A.1.4	For new school construction, using the model of ASCE 7 (US design loading standard), use a uniform seismic design category (SDC D or E recommended) for school structural and non-structural component detailing. This risk-based design approach allows for a minor increase in cost for a significant return in risk reduction.		Earthquake

A.1.5	For new school construction and retrofits of existing schools, avoid and/or correct common seismic vulnerabilities (structural and non-structural): Correct or avoid partial height walls below windows (short column effects) Avoid or reinforce non-ductile unreinforced masonry walls between classrooms Anchor heavy furniture such as bookcases and filing cabinets using L-shaped connections Anchor hung ceiling panels to structure with suspended cables (failures occurred in Chile, Christchurch, Virginia earthquakes) Fix fire-protection pipes to the ceiling structure. Do not leave corners floating Use chains to connect the fire extinguishers and power/gas supply to structure	Why Schools are Vulnerable to Earthquakes (GHI Report, 2012) FEMA 74 Field Manual Nonstructural Risk Reduction Handbook for Schools	Earthquake
A.1.6	Define a clear area for arrival and departure that may also be used as a meeting point for students/ teachers in the event of an emergency/evacuation		Flooding, earthquake, landslide, severe storm, fire, terrorist attack or active shooter, infrastructure failure

A.2 ARCHITECTURAL AND SITE DESIGN

#	Recommendation	Related References and Case Studies	Related Shocks / Stresses
A.2.1	Integrate passive design concepts into the school buildings through orientation of the building, natural daylight, cross ventilation to avoid the need for air conditioning, reduce energy needs and maximize student performance	Green Schools Investment Guide Energy Design Guidelines for High Performance Schools Article on the impact of school environment on academic performance UK Passive school case study A Comparative Study of Green School Guidelines	Power outage, energy insecurity, poor air quality, insecure municipal finances, climate change, truancy
A.2.2	Consider shading needs for school buildings to limit solar heat gain. For school grounds, where possible integrate trees and green infrastructure for shading and cooling. Where climate limits options for trees and green infrastructure, consider extensive plants/ gardens and create shade structures	US EPA's Storm Smart Schools Guide	Extreme heat, lack of green space, poor air quality, climate change
A.2.3	Limit impervious surfaces on school grounds to decrease runoff and increase rainwater absorption into the ground	US EPA's Storm Smart Schools Guide CEMEX PermaFlow Pervious Concrete	Flooding, drought, severe storms, subsidence, inadequate sanitation systems

A.2.4	Incorporate active design principles into the school buildings and grounds while ensuring accessibility and special needs requirements are met	Active Design Toolkit for Schools Creating Accessible Schools	Inadequate health systems and declining public health, lack of equity
A.2.5	Ensure classrooms have good acoustic quality. Design buildings to limit noise transfer into and between classrooms. Consider materials that will provide sound isolation (eg carpets and panels) and room/ceiling shapes that will reduce noise amplification	Institute for Advanced Classroom Hearing Classroom Acoustics Resources Designing Quality Learning Spaces	Poor student focus
A.2.6	Promote a healthy school environment. In addition to the recommendations of A.2.1, A.2.4, A.2.5, ensure that materials used in construction, renovation, maintenance and cleaning of schools are safe. Control mold and moisture; institute effective pest management; promote air circulation.	US EPA's Healthy School Buildings Resources Healthy Schools Renovation and Construction Guide WHO WASH Standards for Schools	Inadequate health systems and declining public health, truancy and poor student focus
A.2.7	Design spaces in school buildings for flexibility and adaptability of use – for example, classrooms that can be converted to auditoriums. Consider new ways of organizing the classroom to facilitate collaboration and creativity (eg 'didactic corners' or round tables and circular seating instead of fixed desks and chairs) while also ensuring space for privacy and reflection when needed	Flexible Learning Spaces Case Study from NZ	Multiple shocks/ emergencies, truancy and poor student focus
A.2.8	For new school design, estimate the anticipated future capacity needs over the asset's useful life and design flexibility for expansion into the initial design. For example, design the structure and foundations of a single-story building for a possible second floor addition so it may be expanded in stages.		Population growth, displaced populations and migrants, shifting macroeconomic trends, inadequate infrastructure
A.2.9	Design school buildings and grounds to accommodate physical/social interaction and partnership between students, teachers and the community. Avoid physical barriers that isolate them from surrounding areas. Designs should include accessibility and openness while protecting children from surrounding hazards such as violence. Consider a layered approach with varying degrees of public and private facilities which can also provide resources and services to the wider community. For example, a central private and protected 'core' school for students; controlled public facilities such as libraries, community, arts and performance spaces, and playgrounds surrounding it; and public parks accessible to students on the periphery.	Educative Citadel Nuevo Latin containing CDI and public library/cultural center	Extreme heat, riot/ civil unrest, inadequate infrastructure, lack of green space, lack of social cohesion, aging populations, youth disenfranchisement, urban blight, crime/ violence
A.2.10	Design and build schools and sites with locally-available materials, construction techniques and labor to stimulate local economy and reduce reliance on and cost of foreign products	Build Change Safe Schools projects	Undiversified economy, unemployment, aging infrastructure, insecure municipal finances

A.2.11	Design schools and sites with materials, finishings and furnishings that require low maintenance and upkeep	OAS Maintenance Manual for School Buildings in the Caribbean	Aging infrastructure, insecure municipal finances
A.2.13	Consider building designs with shared spaces and central patios/courtyards surrounded by classrooms. The central patio can serve as a meeting point, auditorium and play area		Lack of social cohesion, truancy and poor student focus
A.2.14	Update national regulations for school zoning to allow for more flexibility in their application to different local contexts and needs (eg requirements for parking spaces) through form-based zoning, performance zoning and/or impact zoning.	Form-based Codes Performance-based Zoning Re-Code LA (zoning code types)	Varied shocks and stresses
A.2.15	Avoid concealed or unsupervised spaces where bullying, violence or use of illicit substances may occur	Washrooms to prevent bullying	Crime/violence, bullying, drug-use

A.3 BUILDING SERVICES

#	Recommendation	Related References and Case Studies	Related Shocks / Stresses
A.3.1	Ensure all classrooms and facilities have access to high-speed internet to provide global connectivity and access to global learning resources		Multiple shocks/ emergencies, youth disenfranchisement, undiversified economy and unemployment, insularity
A.3.2	Incorporate sustainable and green features into school buildings including solar power, composting (for vegetable gardens), rainwater collection and reuse	Green Schools Investment Guide	Energy insecurity, water insecurity, climate change, inadequate sanitation, insecure municipal finances

B - Operations-related Recommendations

B.1 FACILITIES MANAGEMENT/MAINTENANCE

#	Recommendation	Related References and Case Studies	Related Shocks / Stresses
B.1.1	Develop monitoring systems that can be used for day-to-day operations and asset management but also for early response to disasters		Earthquake, flooding, drought, extreme heat, aging infrastructure
B.1.2	Include 'X' years of maintenance in the initial facilities construction contracts to incentivize quality construction by the contractor	Approach used in India (GHI)	Infrastructure failure, aging infrastructure, lack of investment
B.1.3	Develop a program for co-management of facility maintenance, cleaning and improvements (and associated fund management) by parents, students and communities to promote a culture of care and respect for the physical infrastructure	Japan example	Infrastructure failure, aging infrastructure, lack of investment, insecure municipal finances, vandalism

B.2 FACILITIES-TO-CURRICULUM LINKAGES

#	Recommendation	Related References and Case Studies	Related Shocks / Stresses
B.2.1	Create agricultural grounds and gardens as classroom extensions and to generate vocational opportunities for students and teach them about commerce and support food security	Alice Waters' Edible Schoolyard Project	Lack of green space, food insecurity, undiversified economy, unemployment, youth disenfranchisement, inadequate educational curriculum
B.2.2	Operate the school as a sustainable and resilient system and incorporate data collection and monitoring of the system in school curriculum (eg monitoring of weather, flood gauges, seismograph, energy use, water collection, volume of waste vs composting vs recycling). Create an educational program for children about their natural environment, risk exposure and risk mitigation solutions	UNICEF's Integrating DRR into School Curriculum Whole Schools Sustainability Framework	Drought, flooding, earthquake, extreme heat, energy insecurity, poor air quality, water insecurity, inadequate sanitation systems, climate change, inadequate educational curriculum
B.2.3	Invite local artists, crafts people, scientists etc to share knowledge and career pathways with school children in public/private community spaces located on school grounds		Lack of social cohesion, unemployment, youth disenfranchisement, ethnic inequality, gender inequality, inadequate educational curriculum
B.2.4	Consider the furniture, finishings, floors, ceilings and plantings as a 'third teacher'		Truancy and poor student focus, inadequate educational curriculum

B.3 COMMUNITY INTEGRATION

#	Recommendation	Related References and Case Studies	Related Shocks / Stresses
B.3.1	Use the school as a multi-purpose, cultural utility that provides resources and services to the wider community such as libraries, internet access, performance/arts spaces, playgrounds, gardens, meeting rooms. Engage members of the community early on in the design of the school to identify community needs and implications for the design	Medellin Library Parks Sabre Kindergarten Schools in Ghana	Lack of social cohesion, lack of green space, urban blight, uncontrolled urban development, crime/violence, youth disenfranchisement, aging population, inadequate infrastructure
B.3.2	Leverage facilities and parks near schools for educational, cultural and recreational opportunities for students	La Bobata, El Volcan in Cali, Colombia	Lack of social cohesion, unemployment, youth disenfranchisement, ethnic inequality, gender inequality, inadequate educational curriculum
B.3.3	Consider locating schools near senior homes and health care facilities to provide multi-generational interaction	Multi-generational Planning Guide	Lack of social cohesion, aging population, lack of green space, inadequate infrastructure
B.3.4	Establish clear rules about the use of shared public/ private spaces and facilities between the school and community		Crime/violence, urban blight, uncontrolled urban development, lack of green space, lack of social cohesion
B.3.5	Consider the use of contests or competitions to select students and/or community members to enhance school grounds with murals, temporary and/or permanent artwork and other embellishments.	Herbario Virtual	Lack of social cohesion, inadequate infrastructure, youth disenfranchisement, poor student focus, vandalism

C - Systems Connections And Related Recommendations

#	Recommendation	Example	Related Shocks / Stresses
C.1.1	The planning of educational infrastructure should be conceived as a system in order to optimize use of resources, not only for prioritizing upgrades but also planning new infrastructure based on future needs.		Multiple shocks, population growth, displaced populations, inadequate infrastructure, aging infrastructure, inadequate public transport, economic inequality
C.1.2	Develop emergency plans for schools in the event of a major disaster like an earthquake including how schools will be inspected/tagged, which schools must be designed for continued operation (and which students will be relocated to these schools post-disaster), and how schools will be rebuilt (pre-disaster recovery planning)	Resilient Schools Through Leadership and Community Engagement UNISDR Pre-Disaster Recovery Planning FEMA Pre-Disaster Recovery Planning Guide for Local Governments School Disaster Recovery Plan FEMA Multi-Hazard Emergency Planning for Schools BORP	Earthquake, flooding, severe storm
C.1.3	Schools should be insured for fire, flood and earthquakes. Consider a quick type of insurance such as parametric insurance which can both transfer risk and speed recovery.	Report on the Feasibility of Risk Financing for Education	Earthquake, flooding, fire
C.1.4	For schools in close proximity to rivers/creeks, acknowledge and plan for associated risks and leverage access to the river for educational and recreational benefits		Flooding, climate change, environmental degradation, inadequate educational curriculum
C.1.5	Leverage the construction of new schools and retrofit of existing schools to train local builders and communities in hazard-resistant construction techniques	Build Change's Training Program in Colombia GHI's New Dehli School Retrofit Jamunal project	Earthquake, unemployment, undiversified economy, poor governance/ regulatory climate, inadequate infrastructure
C.1.6	Establish communication and coordination among government agencies, designers, builders and operators to align between national and local goals and priorities		Poor governance/ regulatory climate, political instability
C.1.7	Understand how students and parents commute to schools and ensure safe, multi-modal options are available to all families: Ensure pedestrian safety and accessibility in the vicinity of schools (traffic calming, reduced speed limits, crosswalks and crossing guards) Establish a Safe Routes to Schools program Consider bike-share for schools Provide school buses for students to reduce individual car drop offs	Safe Routes to School Programs	Traffic congestion, traffic injuries, urban blight, inadequate infrastructure, climate change, poor air quality

D Other References

- GFDRR Global Program for Safer Schools
- Towards Safer School Construction: A community-based approach, Global Alliance for Disaster Risk Reduction & Resilience in the Education Sector
- Worldwide Initiative for Safe Schools (WISS), UNISDR
- Comprehensive School Safety Framework, UNISDR and Global Alliance for Disaster Risk Reduction and Resilience in the Education Sector, 2014
- School Earthquake Safety Initiative (SESI), Earthquake Engineering Research Institute (EERI)
- Optimal Learning Spaces: Design Implications for Primary Schools, SCRI Research Report 2, 2009
- 33 Educational Design Principles for Schools and Community Learning Centers, School Design Studio

E - Attachments

- Write up on Mexico Housing Code (shared by Alberto Herrara, International Code Council)
- Presentation on 'Barrios Resilientes' initiative in Mexico City, CDMX Resilience Office (shared by Pipola Gomez, Deputy CRO, CDMX)
- Reducing Seismic Risk in Existing K-12 Schools: A Guide for School Administrators, FEMA, 2002 (Shared by Fred Krimgold)
- Guidance Tool for National and Local Governments on School Seismic Safety Program, United Nations Centre for Regional Development, 2009 (Shared by Fred Krimgold)

F - Participants

In addition to City of Cali participants and stakeholders and 100RC staff, the following 100RC Partners participated in the development of these recommendations:

- AECOM
- AIR Worldwide
- American Institute of Architects (AIA)
- Build Change
- Findeter
- GeoHazards International (GHI)
- Global Earthquake Model Foundation (GEM)
- International Code Council (ICC)
- Inter-American Development Bank (IDB)
- World Bank GFDRR
- WSP
- Dr Fred Krimgold and Barbara Krimgold
- Mexico City Resilience Office