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New Providence Transport Program
Bahamas

Figure 1: Completed corridor for the New Providence Transport Program
Sources: Smith, Kurt, Project Execution Unit, Ministry of Works and Urban Development, October 26, 2015. Nassau, Bahamas

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Cases are not intended to serve as endorsements, sources of primary data, or illustrations of effective or ineffective project design or implementation.

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EXECUTIVE SUMMARY

The primary objective of the New Providence Transport Program (NPTP) was to provide road users a more rational and efficient transport system to reduce transportation costs to its users. The inordinate congestion suffered within the highly urbanized area of New Providence was to be alleviated by expanding the existing road network, strengthening the institutional framework responsible for the provision of transportation services, improving road safety, and reducing the negative environmental impacts associated with the existing traffic congestion levels. Remediation efforts to offset these negative impacts were concentrated in a singular site of high significance to the community, rather than multiple dispersed sites. The efforts culminated in an environmental restoration of a 181 acre park to the benefit of the public.

Conceived in 1994, the large scale infrastructure investment was funded through loans from the IDB and supplementary public loans from the Government of the Commonwealth of the Bahamas (GoBH). Executed in phases, the totality of the improvement efforts currently nearing completion required an aggregate expenditure of approximately US $195 million. Funds were primarily provided for the physical works that included 23 km of road improvements, and 15 km of new road construction. Engineering studies that mitigated against environmental and social impacts were also commissioned while other investments were also made to strengthen and develop institutional capacities. With widespread automobile use, the improvement project had a direct impact on the community as a whole, reducing travel times, improving the mobility of passengers and the safety of pedestrians, while simultaneously enhancing public space.

The NPTP positively impacted the quality of life of the affected communities on the Island of New Providence. The physical, economical, and social impacts of the improvement project were assessed during the preliminary planning stages through the Environmental and Social Impact Assessment. The report addressed the functional impacts of the project, a concern for the wellbeing of the individual health, comfort, and mobility of those affected, and the safety of the larger community.

The limited road hierarchy present on the island influenced project concerns for the safety and wellbeing of both residents who navigate the roads in vehicles and the tourists maneuvering the streets of Nassau as pedestrians. As a result, modifications to existing intersections and some new construction enhanced wayfinding and greatly improved pedestrian safety. Outside the city, pedestrian refuges and associated guardrails were constructed near schools, where localized speed reductions and high-visibility advanced warning signs were installed.

Subsequently Road Safety Audits (RSA) were carried out to protect the integrity of the investment. Overall, the project goals align to the needs of the local community while enhancing the city center's marketability and economic viability as a safe and navigable tourist destination.

The project team demonstrated exemplary leadership throughout the program's implementation, reaping the rewards of a holistic collaboration with the community, all while successfully managing the integration of the new infrastructure so as to ensure the performance of the project was maintained in the long term.

With automobile use projected to rise on the Island, the long term sustainability of the urban transport system rested on the project team's ability to encourage the use of alternative forms of transportation. The Transport Development Plan (TDP) formed the direction for many of the improvements that would integrate the additional infrastructure into the existing network. Initiatives included rationalizing the public transportation route sector, the development of a bus parking depot in downtown Nassau, and Ministry of Education led research into the effects of staggering school start and stop times to spread out the morning rush hour. To monitor their efforts in the long term, corridor specific Environmental Management Plans (EMPs) were prepared and subsequently monitored by an independent supervisor. Quarterly audits outlined bi-weekly site meetings and site visits to report on successes as well as outstanding non-compliance issues. The project team's establishment of both short and long term monitoring efforts ensured that their studied enhancements were carried out in their entirety. Making appropriate use of their investments to strengthen and develop institutional capacities the NPTP demonstrated desire and ability to lead by example.

In interfacing with the environment, the NPTP demonstrated a high level of awareness to the extent of its impacts and successfully considered ways to engage with and enhance its relationship to the natural site. The careful consideration of land, water, and biodiversity allowed the project to coexist among the natural systems present on the Island. The unique low-lying geology of the Island, prone to surface and groundwater contamination, was consistently monitored to prevent pollution, soil erosion and silt runoff, while materials stored during construction, and contaminated materials for disposal were also addressed. Vertical drainage wells were widely used to assist in these efforts, capturing surface runoff and redirecting it past the sensitive freshwater lens found just below the ground surface. Avoiding disruptions to existing hydrologic patterns, drainage ditches along roadsides were also inspected to safeguard water bodies against pollution.

Throughout construction, restorative measures took place on site to improve the soil's ability to support healthy plants, biological communities, and water infiltration. The soil disturbance inherent in road improvement projects of this kind was mitigated against through its reuse elsewhere. The valuable topsoil was separated from subsoils, carefully stored, and later used in landscaping improvements along roadsides. Stabilized against erosion with native plants, the planted embankments served to promote habitat connectivity. The foresight of the project team allowed for the impacts of the road improvement project to be greatly reduced, facilitating its synergy with the natural environment in which it was built.

The cohesive relationship between the improvement project and the natural environment also demonstrated a project alert to the risks of a changing climate. Preparing for both the natural and human induced short term hazards while also decreasing the project's vulnerability over the long term, the NPTP represents a noticeably resilient project.

Hazardous material spills on road surfaces were a short term risk the project team successfully identified and protected against. Although legislation in the Bahamas does not exist that would govern reliability in the event of a spill, the Transport Program commissioned a Hazardous Materials Spill Contingency Plan (HAZMAT Plan) which established the organizational procedures that would enable an effective and timely response to any incident. In the long term, preventative design measures contributed to community robustness by defending against future flooding, one of the island's most characteristic vulnerabilities. By identifying low lying areas prone to 'ponding' vertical drainage wells were inserted to promote water infiltration. Although the expected influence of this design decision was not known at the time of implementation, after significant rainfall and hurricane events, areas utilizing this system were observed to be free of water, allowing emergency response units access to the affected areas. The proactive nature of the project team ensured their long term vision protected their investment well into the future.

The investment of the NPTP extended far beyond the augmentation of the road network. While the additional corridors would have sufficed to accomplish the goal of alleviating congestion, a habitat mitigation feature initiated by the BEST commission for the NPTP and continued by the Ministry of Works and Transport, restored a publically accessible open space and natural resource known as Big Pond. Investments in planning and more than a decade of community interest in the remediation of this contaminated site, extended the original scope of the masterplan to create a 181 acre habitat that serves the public through educational and recreational facilities.

The rehabilitation of the Big Pond area resulted in high levels of achievement provided its restorative nature and represents the most significant contribution of public space to the community from the NPTP, advancing the expectation of future sustainable projects. A project in itself, fulfilling the vision of Big Pond required coordinated efforts between project planners and stakeholder groups. With an estimated budget of US $56 million, the masterplan utilized a phased approach prioritizing the restoration and conservation of the open water portion of Big Pond. With 32 acres of water surface area, the pond serves as the destination of 16% of the Islands' stormwater runoff. As an important retention area, large investments were made to restore and conserve the existing water while contaminated soils were removed to facilitate infiltration and improve overall water quality within the pond. With a remaining area heavily populated with vegetation and pocketed with wetlands, the habitat was restored to provide the ecology necessary for the future flourishing of native flora and fauna.

The park was successfully woven into the community through considerate integration into its adjacent land uses. Vehicular and pedestrian traffic patterns around the perimeter paired with walking trails through the park enhance this connectivity and communicate safety. The College of the Bahamas, the high school, and two primary schools all surround the Big Pond area furthering the opportunities to engage with the unique site. The increased access and addition of visitor facilities and sports complex have together created a new public space that generates a significant benefit to the community, instilling a sense of importance of the park. The responsible planning and tactful execution over a significant period of time have ensured that the Big Pond will undoubtedly serve as a focal point and destination on the island for years to come.

In spite of the considerable proficiency demonstrated by the Transport Program in relation to the aforementioned actions, the potential for improvement remains. Opportunities to develop local skills, address the needs of vulnerable groups, and perhaps most noticeably, diligently steward material resources, await further action.

A program of this scale can bring multiple benefits to New Providence, such as, opportunities to train up,grow a local workforce, and strengthening local skills in design, construction, and operation.. In this regard, the program could had provided a framework of collaboration between international contractors and national contractors. However, the consolidation of works in one large package and utilizing the design-build modality, for the initial execution of the Program, excluded local contractors who lacked experience in this delivery method. Besides, this methodology was expected to reduce the execution time of the construction works, but due to the bankruptcy and abandonment of the project by the original contractor

and the inexperience of the Executive Agency in utilizing this approach, delays in project execution increased to several years. The bankruptcy of the first contractor, ultimately shifted portions of the work to local contractors, (Corridor 14, 2 and 3) opening bidding to an international labor market, but nevertheless this modality did not show any comparative advantages, savings or improvements.

On another level, project documentation did little to communicate ways in which the project contributed to the enrichment in quality of life for vulnerable, affected groups. Meetings and consultations with community stakeholders are essential to understanding the unique needs of affected communities. Understanding that the perceived 'benefits' of participation that particular stakeholders receive over others can reinforce gender and social inequalities if not handled intentionally and with a purpose. As a result, special efforts should be taken to identify the potential of the entirety of the labor force alike, women and other diverse groups included.

Moving from the labor force to the assets needed to construct the infrastructure, the NPTP performed poorly relative to its allocation of resources. While the lack of available recycled or regional material was no fault of the project team, much more could have been done to assess the project's overall energy needs as a way to measure its subsequent consumption. The NPTP was not able to provide measured percentage reduction of energy use against baseline industry norms, due primarily in part to the lack of assessment prior to project commencement. Projects of this scale and significance to a region should maintain as goals not only the reduction in overall energy use but also the use of renewable sources whenever possible. In offsetting operational consumption over the life of the project through renewable sources, the NPTP could investigate solar powered alternatives to the program's largest energy expenditure – lighting. In short, the import culture prevalent on the Island is understood to be the norm, but should not prevent resourcefulness as it is possible. From a sustainable perspective, physical materials - those that are consumed and those that leave the project - energy, and water, must be understood as finite – resources that should be used sparingly and respectfully.

1. PROJECT DESCRIPTION & LOCATION

The New Providence Transport Program is a public project developed and executed by the Ministry of Public Works (MOW) of the Commonwealth of the Bahamas, which is responsible for all construction and ongoing maintenance. In conjunction, the Ministry of Transport (MOT) has implemented a new transportation policy, and is regulating the continually evolving system of transportation services.[1]

This large scale infrastructure investment was funded in part through several loans from the IDB totaling US $148 million, as well as supplementary public loans from the Government of the Commonwealth of the Bahamas (GoBH) totaling US $46.8 million.[2] The decade-long initiative was aimed at providing a more rational and efficient transportation system for New Providence Island, and was executed in phases (largely due to funding availability). With initial financing secured in 2001, early project work ran through 2008, at which point additional financing was made available to carry out approximately 75% of project completion by 2011.[3] With 95% of the budget exhausted, further funding was secured to complete work by the end of 2012. The aggregate total for the construction works was approximately US $195 million.

Several construction companies executed the project throughout the different phases. In 1999 Mott MacDonald developed the 19 corridors used by the Ministry of Works for tendering a "Design Build Project."[4] As a result of the tender process, a "Design Build" contract was awarded to Associated Asphalt in 2001. Associated Asphalt commenced and partially completed construction on seven corridors , however, the company went bankrupt circa May 2002. The project was halted at this point, and between 2002 and 2007 a number of strategies were developed to get the project re-awarded for construction. In 2008 the lowest evaluated bidder for the remaining corridors was Jose Cartellone Civiles Constructores (JCCC) from Argentina, which was awarded the contract to complete the program. The works were substantially completed by early 2013 and required refinements were concluded by early 2014.

The Government of The Bahamas's (GoBH) strategy is based primarily on the "Transport Development Plan" (TDP) for New Providence Island, prepared by the consulting firm M.M. Dillon Ltd.[5] The comprehensive study, conducted in 1995 covered all aspects of urban transport

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1 IDB. *Project Profil*e. BH-L1029, 4. (hereafter cited as PP) Retrieved from http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=36731364 (Accessed September 3, 2015)

2 Ibid., 3.

3 Ibid., 2..

4 *New Providence Transport Program: Executive Summary.* BH-0029, (2015), 1-3. (hereafter cited as ES)

5 Ibid.,2

on the island and presented policy recommendations, as well as detailed action plans for implementation and the restructuring of the governing institutions. The New Providence Transport Program has ultimately provided the financing necessary to implement key action plans outlined in the research.

Targeting the existing road network focused around the capital city of Nassau, the program seeks to reduce transportation costs for both pedestrians and automobile users alike, by improving the existing road works, modernizing the transportation services system, and reducing environmental impacts associated with high congestion levels.

The Transport Program will greatly benefit the community it serves. Lacking an identifiable road hierarchy, Nassau suffers from inordinate traffic congestion due to local automobile use which is coupled by tourists traveling between cruise ships at Nassau Harbor and the city.[6] With a high ownership rate of 1.34 vehicles per household on the island (which is expected to rise), the Transport Program positively affects a large portion of the population.[7] By relieving significant congestion and reducing travel times along the main arteries of New Providence Island, the Transport Program improves mobility of both passengers and articles; thus bolstering the economic potential of the island from trade, as well as the increased attractiveness of the Island as a tourist destination.

The program was a combination of three major components: roadway development and traffic management, engineering studies, and institutional development and strengthening.[8] The physical aspect included 23 km of road improvements and 15 km of new road construction. The great majority of these works were focused in and around Nassau, however the main east-west link across the island was also widened from two to four lanes. A multitude of traffic management measures intended to optimize capacity was carried out in all of the corridors. Ranging from added signage and pavement markings to controlled intersection geometric designs, the improvements greatly improved overall road safety.[9]

Engineering studies concurrent with the construction in a highly urbanized environment addressed preliminary design and feasibility work, while also supporting environmental supervision and audits that ensured the mitigation of local environmental impacts. Prior to commencing the work, five areas[10] were identified as being at risk for contamination from

[6] PP, 2.
[7] ES, 25.
[8] Ibid., 1-2.
[9] Ibid., 5
[10] Ibid., 29.

surface runoff and accidental spillage, however, The Environmental and Social Impact Assessment (ESIA) prepared by the GoBH observed that ecological impacts associated with road improvements were ultimately of minor concern.[11] Visual intrusions and other temporary effects of the construction (such as noise and dust) were monitored to ensure that appropriate environmental and social impact mitigation efforts were made during the construction phase.[12]

The provided documentation for review during the project evaluation relates in large part to the planning stage of the project. Materials that address specific outcomes of planned initiatives in order to understand the level of achievement toward these goals is unavailable; therefore the project may not have ultimately followed its intended path.

2. APPLICATION OF THE ENVISION RATING SYSTEM

New Providence Transport Program, Bahamas

The EnvisionTM system is a set of guidelines that aid in optimizing the sustainability of an infrastructure project during the planning and preliminary design phases, as well as a means to quantify the relative sustainability of the project. In this case study, the infrastructure to be assessed is the road improvement project for New Providence Island in the Bahamas.

Envision consists of 60 credits grouped into five categories: Quality of Life, Leadership, Resource Allocation, Natural World, and Climate and Risk. Each credit pertains to a specific indicator of sustainability such as reducing energy use, preserving natural habitat, or reducing greenhouse gas emissions. Those credits are rated on a five-point scale referred to as a 'level of achievement': 'improved', 'enhanced', 'superior', 'conserving', and 'restorative'. Evaluation criteria are provided to determine if the qualifications for each level of achievement have been met for a particular credit. In each of the five categories there is a specific credit called "Innovate or exceed credit requirements". This is an opportunity to reward exceptional performance that applies innovative methods within the subjects that Envision evaluates.

The criteria for the levels of achievement vary from credit to credit, but generally an 'improved' level of achievement is awarded for performance that slightly exceeds regulatory requirements. 'Enhanced' and 'superior' levels indicate additional gradual improvement, while 'conserving'

[11] Mott MacDonald., *Environmental & Social Impact Assessment:* Nassau: Mott MacDonald. From the Government of the Commonwealth of The Bahamas, (2000), 3. (hereafter cited as ESIA) Retrieved from http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=37115353.
[12] Ibid., 144.

often indicates performance that achieves a net-zero or neutral impact. 'Restorative' is the highest level and is typically reserved for projects that produce an overall net positive impact. The Envision system weighs the relative value of each credit and level of achievement by assigning points. Credit criteria are documented in the Envision Guidance Manual, which is available to the public on the ISI[13] and Zofnass Program[14] websites.

3. QUALITY OF LIFE CATEGORY

Envision's first category, Quality of Life, pertains to potential project impacts on surrounding communities and their respective wellbeing. More specifically, it distinguishes infrastructure projects that are in line with community goals, clearly established as parts of existing community networks, as well as consider the long-term community benefits and aspirations. Quality of Life incorporates guidance related to community capacity building and promotes infrastructure users and local members as important stakeholders in the decision making process. The category is further divided into three sub-categories: Purpose, Wellbeing, and Community.

Purpose

The "Purpose" subcategory examines the project's impact to the affected community, considering aspects such as community engagement, economic growth and local capacity building.[15] The implementation of the New Providence Transportation Program promoted local growth through a better transportation network, but at the same time opportunities for integrating the community in the decision-making process, and the enhancement of local knowledge for long-term competitiveness were lost.

The project demonstrated concern for the affected population and the governing body took steps to engage the public in the planning process in a variety of ways. Radio "chat shows" were established for the public to voice their concerns and a local community liaison was appointed to communicate (in writing) to the affected community, ensuring timely notice of activities which were likely to affect them.[16] A higher level of community-based performance would have ultimately been achievable, had documentation outlining instances of planning changes executed to accommodate community members' specific requests been provided.

[13] www.sustainableinfrastructure.org

[14] www.zofnass.org

[15] Zofnass Program for Sustainable Infrastructure. *Envision ENV PV/Verifier Manual.*, Institute for Sustainable Infrastructure, 2015, 20. (hereafter cited as ENV)

[16] ESIA, 148.

A bi-product to the infrastructure improvement project was the stimulation of sustainable economic growth. While the expansion of the road network inherently created local jobs in construction, the Transportation Program also invested significantly in "Institutional Development and Strengthening"[17] in order to create additional jobs targeted towards improving management procedures, road maintenance, and public transportation - jobs that would endure beyond the construction phase of the project. Moreover, the restoration of the Big Pond Area contributed to the recovery a recreational space for the community in a highly urbanized context, improving their overall liveability.

Furthermore, the employment of a local labor force allowed for the development of local skills and capabilities. Unfortunately, given the Design-Build[18] nature of the project, incentivizing contractors to work quickly resulted in bids from foreign companies of greater competency and experience being awarded. However, the project managers should not be faulted in this regard as the scale and complexity of the endeavor necessitated the need for a builder of considerable expertise. Room for improvement may exist in the opportunity to further engage the community with the project, perhaps by accommodating reasonable changes to the project scope to reduce the number of those displaced by the widening roads.

Wellbeing

The Wellbeing subcategory addresses individuals' comfort, health, and mobility as an integral part of the community. During construction and operation, the physical safety of workers and residents are to be ensured, while disturbances are minimized. Attention is also given to encouraging alternative modes of transportation, and incorporating the project into the larger community mobility network.[19] The Transport Program for New Providence scores highly in all of the aspects related to Wellbeing.

The level of concern for the health and safety of local residents was evidenced in the formation of several project teams that acted during all stages of the project's development. By way of The Environmental and Social Impact Report, numerous risks to the public were assessed prior to the commencement of work. Identified as one of five areas at risk for contamination from surface runoff and accidental spillage, the Big Pond Area along Corridor 8 received special attention early on. For safeguarding the Big Pond Area, a Spill Response Team (SRT) comprised of personnel trained in health and safety issues was created.[20]

[17] PP, 2.
[18] ES, 4
[19] ENV, 18.
[20] ESIA, 27.

In a more localized effort, each corridor of the project's improvement plan was addressed individually with regards to noise impacts. Vegetation and landscaping plans to mitigate noise levels were developed specifically for Corridors 8, 9, and 14, while a noise-monitoring plan during construction was implemented in Corridor 13 to minimize adverse social impacts.[21]

With the location of the project having been chosen to utilize and improve the existing transportation infrastructure, the Transport Program did not expand urban sprawl, but instead improved mobility and access within the existing area. By encouraging walkability at the micro level, while reducing traverse times throughout the island at the macro level, benefits to both the pedestrian and commuter alike are readily observable. While overall accessibility to alternative modes of transportation has been improved, and a further integration of transportation networks achieved, bike paths are not mentioned, therefore possibly not integrated into the system, an effort that would prove demonstrative of the project's openness to a future where alternative forms of transportation are available and encouraged.

Community

The Community subcategory measures the preservation, and/or improvements a project makes to its surroundings through context-sensitive design. These considerations are important both in rural and urban settings in order to preserve the natural views and local character. In the case of the transportation program, some considerations were included regarding these aspects, however still there is room for improvement.

The Environmental & Social Impact Assessment (ESIA) issued prior to commencement of the work was a thorough analysis of the project's social, economic, and environmental impacts on the area. During the course of their review, Lucayan petroglyphs were located by topographic survey near Corridors 5 and 19[22]. Given their robust archaeological significance as the only known petroglyphs in New Providence, special care was given during construction so as to avoid their destruction, but no further efforts were made to ensure their preservation.

To ensure the local character of the area was maintained, special consideration was given to resultant views and sightlines created as a result of the project. The widening of select corridors as identified in the ESIA report required the removal of vegetation, which negatively impacted views from upper-floor residences. Care was taken to ensure re-planting of local plants to mitigate visual intrusions, and if necessary, screen walls were built to further shield sight lines.[23]

[21] ESIA, 185.
[22] Ibid., 23.
[23] Ibid., 103

As an added measure of control, during construction project monitoring and field inspections were carried out to ensure compliance with contractual agreements to minimize the impact to views.

Perhaps of greatest merit was in efforts to enhance the public space, as the project team took the unfortunate circumstance of the 1.5 acre infilling of Big Pond[24] needed to complete project, and provided a compensation package to make up for its loss. The compensation package subsequently influenced a widely endorsed development proposal to designate Big Pond as an urban wildlife park and greenspace.[25]

Further opportunity for improvement within the category exists with most of the aspects which were analyzed; a compelling argument could be made for the addition of a facility that addressed the petroglyphs within the archaeological site. A small visitor pavilion could provide an opportunity to educate the public on the significance of their patrimony, which may in turn help to ensure their preservation for future generations.

Vulnerable groups

The vulnerable groups category assesses achievement based on the extent to which the project contributes to the quality of life for women and diverse groups. The large scope of infrastructure projects implies the presentation of a multitude of opportunities for the affected communities in the form of jobs, education, and the development of unique skills, among others. The perceived "benefits" can reinforce gender and social inequalities if not handled intentionally and with purpose, which is why it is is necessary that project leaders identify ways in which all of those impacted can gain from the improvements. The New Providence Transport Program did not offer project specific documentation that addressed this credit directly, and consequently no points have been awarded.

The first aspect analized, Identify and address the needs of women and diverse communities, aims to improve the quality of life of women and diverse groups living in the communities surrounding the project, while mitigating potential negative impacts that they may endure. Meetings and consultations with community stakeholders are understood to be essential in understanding the issues and concerns of those affected, and special efforts should be made to ensure that the project has taken their views into account.

Secondly, Stimulate and promote women's economic empowerment, targets women's economic empowerment through sustainable livelihoods, local procurements, job creation,

[24] ES, 30.
[25] Ibid., 31.

capacity building, and training. Achievement within this category is measured based on the extent to which a project impacts women's livelihoods and capabilities. The potential to grow a local community's skillset should never be passed over, as future projects may reap benefits from past investments, evidenced through the creation of an experienced local labor force.

Finally, Improve access and mobility of women and diverse communities, incentivizes the project team to locate, design, and construct the project understanding the various patterns and needs of mobility of the different social groups affected. In order to ensure that the infrastructure project is equitable for both women and men, gender disparities must be addressed.

4. LEADERSHIP CATEGORY

Leadership evaluates project team initiatives that establish communication and collaboration strategies early on, with the ultimate objective of achieving sustainable performance. Envision rewards stakeholder engagement as well as encompassing a holistic, long-term view of the project's life-cycle. Leadership is distributed into three sub-categories: Collaboration, Management, and Planning.

Collaboration

The collaboration category examines new levels of leadership and commitment from the project team and new ways of managing the process.[26] It encourages open lines of communications allowing all those involved to contributes ideas and perspectives. The collaboration of many different stakeholders in the New Providence Transport Program provided the leadership necessary to achieve a sustainable project that contributes positively to the world around it. This effective leadership, supported by sustainability management systems, teamwork at all project levels, and the involvement of the public, contributed to significant achievement within this category.

Partnerships at the highest level, coupled with third party consulting offices, created a Ministry of Environmental Planning and Protection to ensure the project led in matters of sustainability.[27] Expressing an even greater care during execution, oversight was assigned to an Environmental Manager and his team, ensuring compliance at the local level, where detailed checklists of mitigation tactics were provided for each unique corridor. Leaders systematically implemented direction to contractors limiting their social and environmental impact, instilling a metric for a greater standard of care for future work. Noise limits imposed on equipment

[26] ENV, 48.

[27] *Supplementary Financing for New Providence Transport Program - Bahamas Environmental and Social Impact Repor*t, (2008), 13. (hereafter cited as ESIR)

further demonstrated a leader's initiative within the community.[28]

Collaboration with all stakeholders, affected and non-affected alike, was established through the appointment of Counsellors who reached out to residents across all social classes to access their localized knowledge and creativity. Lines of communication remained open throughout the course of the project, radio chat shows and town hall meetings[29] facilitating the two way communication that influenced the design through communication. However, further information providing evidence of adjusted plans to suit community insight should be provided to measure how stakeholder participation influenced the project.

Understanding the importance of early, structured teamwork, greatly optimized efforts benefitting the team and the community it served. While significant road closures were the norm due to the nature of the project, measures were taken to ensure those affected received appropriate notice.[30] Even so, the establishment of a more comprehensive planning system to match the complexity of the project could have informed a sequence of road closures that would have had the minimal impact on residents.

Management

The Management category represents a broader, more comprehensive understanding of the project that can allow the team to pursue synergies between existing systems at all scales and periods of a project's lifespan. Consideration for both the short term and long term effects of the improvements facilitated significant achievement within this category that will inevitably protect it against future problems.

Unfortunately, the New Providence Transport Program did not provide documentation supporting the pursuit of by-products to be used in construction, and consequently, no synergistic efforts across industries can be observed. General assessments of potential partnerships with nearby facilities is an initial approach that is recommended to identify facilities that could offer a useful byproduct- understanding that resources bound for waste streams can be captured and used to local benefit.

Regarding the improvement of infrastructure integration, the Transport Program for the Island of New Providence, set out to not only improve the existing infrastructure, but to also extend it, enhance its road hierarchy[31], and integrate it into the urban fabric. To do so many of the improvements to the infrastructure were based on the Transport Development Plan (TDP)[32] developed many years prior, which outlined action plans in direct support of community infrastructure, addressing overall traffic management concerns. In developing a project within the larger TDP, the necessary integration required into existing networks positively benefitted

[28] Halcrow Group Ltd., *Environmental Management Plan EMP1* (Swindon: 2001), 13.

[29] ESIA, 148.

[30] Mott MacDonald. *New Providence Road Improvement Project. 4Th Quarterly Environmental Report* (Swindon: 2013)*, 39*.

[31] ES, 1.

[32] Ibid., 3

commuters, especially travel times to and from schools.

To establish a working synergy with other transport elements, the Office of the Road Comptroller reviewed and rationalized the public transportation route sector at the community level, while the Ministry of Transport developed a bus parking depot in downtown Nassau providing a protected transfer point for passengers.[33] In short, with improved access to resources and facilities, investments at the community level, and an increased flow of goods and services, the NPTP propelled the road networks efficiency to new levels.

Planning

The Planning category adopts a long term view of the project that can greatly increase its sustainability. By avoiding pitfalls and planning effectively for its own future, the Transport Program acknowledged the regulatory framework it operated within and took steps to streamline the process to the benefit of all project participants, facilitating an good level of achievement within this category.

In planning for the long term success of the works, monitoring and maintenance were carried out during all stages of the project. Commitment to the enhancements was evidenced through significant investments in engineering studies, implementing auditing and environmental reporting of planned mitigation efforts during construction efforts.[34] Long term monitoring and maintenance of the project were addressed through quarterly reports addressing site visits, non-compliant issues, and the relevant action plans required to address them.[35]

In an effort to safeguard against future problems, regulatory barriers were identified during the planning stages. The previously prepared Transport Development Plan (TDP) provided regulatory and policy changes for adoption, and while the project team should not be faulted for the slow evolution of public opinion regarding automobile use, to date certain amendments have yet to be implemented.[36] Further efforts are still necessary to improve sustainable performance by ensuring betterment policies are put into place.

Lastly, in measures to extend the useful life of the project the NPTP addressed issues of durability while remaining somewhat flexible to further enhancements in the future. The construction of vertical drainage components along routes to evacuate stormwater[37] demonstrated a protective measure that would safeguard the integrity of the investment into the future. At the community level, an Executive Project Report outlined the realities of achieving long term sustainability goals through the new aggregate infrastructure. Given the behavioral changes that would be required to ensure long term sustainability of the added road

33 ES, 9-10.

34 Ibid., 2.

35 Mott MacDonald. *New Providence Road Improvement Project. 1St Quarterly Environmental Report* (Swindon: 2011), 7.

36 ES, 5.

37 Alejandro, Tapia., *Project Resourcefulness and Adaptability*, Interview by Maria Arrasate. Teleconference (2015)

networks, The Transport Program invested in Institutional Development[38] that instead began to lay groundwork for the policy and regulatory changes that would be needed to ensure a more resilient future.

5. RESOURCE ALLOCATION CATEGORY

Resource allocation deals with material, energy, and water requirements during the construction and operation phases of infrastructure projects. The quantity and source of these elements, as well as their impact on overall sustainability, is investigated throughout this section of the Envision rating system. Envision guides teams to choose less toxic materials and promotes renewable energy resources. Resource Allocation is divided into three subcategories: Materials, Energy, and Water.

Materials

The materials category concerns itself with the quantity of materials used on a given project, and represents one of the most significant considerations for infrastructure projects. Operating with the understanding that significant energy is required at both the moment of extraction of materials from a site, and the subsequent transportation of these materials, the numerous subcategories aim to incentivize the careful consideration of not only the materials involved in a project but also their lifecycle.[39]

The geographically small land area of New Providence Island contributed to significant difficulty in achieving within this category. Subcategories targeting reductions in net embodied energy, supporting sustainable procurement practices, and the use of recycled and regional materials, require a certain level of flexibility in material choice, which the island, geologically speaking, does not provide. For this reason, the majority of the materials used for construction were imported out of necessity.[40] To the project team's credit, the sourcing of materials balanced the safety, stability, and durability of the project's life cycle, as materials of sufficient quality are imperative to improvements of this scale.

Diverting waste from landfills is another significant opportunity that should be taken whenever possible. Although a specific waste management plan was not provided within project reporting, the ESIA did encourage the reuse of soils whenever possible,[41] describing the process of topsoil remediation. Alternatively, the project documents appoint the Ministry of Public Works as the specifier of material types to be used and environmental audits[42] suggest the contractor was not

38 ES, 4.
39 ENV, 86.
40 ESIA, 59.
41 Ibid., 45.
42 Mott MacDonald., *Environmental Audit 9-15 November* (Croydon: 2001), 46

instructed to offer preferential treatment[43] to recycled or sustainable materials. This remains an area where great advancements in sustainable thinking have yet to be made.

It matters of transportation of materials off site and subsequent deconstruction and recycling of construction components, the New Providence Transport Program has ample room for improvement. The project as a whole would benefit from developing a careful inventory of the resources to be removed, potentially producing design documentation that considers the balancing of 'cut and fill.' Furthermore, whether it be earthwork or existing infrastructure, the materials to to be used in the improvements, and the related transportation needs of both, should be utilized based on their ability to provide some future value. Contributions that extend beyond a singular use ensure materials are not taken for granted.

Energy

The energy category is concerned with the consumption of energy a new project introduces into an environment. Given a historical reliance on fossil fuels perpetuating a negative impact on the environment, the category seeks to identify those areas where a project team was able to reduce their overall energy consumption, whether that be by specifying renewable sources or by commissioning and monitoring energy demands to ensure optimum efficiency.

The New Providence Transport Program (NPTP) considered gas emissions resulting from the improvements to the extent that they were understood to be long-term problems[44] that the physical improvement's themselves would not be able to address. Similarly, efforts to reduce overall energy consumption are not evident in measures that would seem typical of other roadway improvement projects. At the localized level, the project team did not have significant opportunities to commission mechanical and electrical systems. However, traffic signals and temporary lights[45] were provided during construction while permanent fixtures were installed along new roads. Specifics of their efficiency in operation are not provided but considering the roadway improvements were based on Florida Department of Transportation (FDOT) standards[46], it can be inferred that these systems met or exceeded industry norms. The opportunity to offset energy consumption through the use of photovoltaic-powered lights may have been missed, as evidence of their studied potential to contribute to consumption reduction was not provided. Even though no high-energy processes are identified in the program, it is recommended to conduct a third-party commissioning to ensure the efficient long-term performance of the lighting systems and traffic signals and to incorporate in the future energy advanced monitoring systems to optimize energy use.

Given the opportunity to divert energy demands from fossil fuel sources, the transport program was not able to utilize or promote the use of renewable energy sources to offset operational

[43] Mott MacDonald. *New Providence Road Improvement Project. 1St Quarterly Environmental Report* (Swindon: 2011), 11.

[44] ESIA, 41.

[45] Ibid., 62.

[46] Francis, Damian., *CNRIP - International Package: Contract Document Volume 2 Specification* (2008)

energy requirements. While New Providence cannot be faulted for the lack of available geography to accommodate these alternatives, the project team should investigate the availability of non-traditional energy sources at off-site facilities. Specifically, solar-powered lighting, including individual solar panel or photovoltaic cells, could be integrated in the future A shifting of a community's reliance on fossil fuels to renewable resources would, even if only in small percentages, create the habits needed for a more sustainable future.

Water

The water category is broadly concerned with the changing availability, consumption, and monitoring of water as a valuable resource and finite asset. Between the increasing urbanization on New Providence Island and the resultant increased consumption, studies that address the changing availability of the resource are particularly important given the scarcity and fragility of potable water on the Island.

The vast majority of New Providence maintains an underground water table very close to the surface. Fresh water lenses are perched just below this and extensive well fields tap these lenses for potable water.[47] Their proximity to the surface results in resources that are very easily contaminated from runoff water or roadside spillages. Acknowledging these conditions allowed the project team to identify particularly sensitive areas and protect them accordingly. Of greatest importance was the vicinity of Perpall's Water Works[48] which supplied drinking water to a section of New Providence. To safeguard against accidental contamination, an Emergency Procedure Plan was put in place by the contractor to establish immediate response actions.[49]

The New Providence Transport Program did not specify reduction in potable water use over the duration of the project, however, the project team demonstrated itself to be responsive to localized needs. While not planned or specified, reparations to leaking distribution pipes encountered during excavation greatly improved potable water distribution and safeguarded against future loss. Given the limited availability of the resource on the Island, the government provides potable water via costly imports or energy intensive desalination facilities.[50] Although these realities were not affected through the road improvement program, the protection of the distribution networks ensures the integrity of the investment. Future alternatives to potable water use, such as the use of greywater, recycled water, and/or storm water should be integrated and promoted in the Island.

Emergency action plans for spillages in the vicinity of sensitive areas[51] and unrequited reparations to water distribution pipes demonstrate the responsiveness of the project team

[47] Alejandro, Tapia., *Project Resourcefulness and Adaptability*, Interview by Maria Arrasate. Teleconference (2015)

[48] ESIA, 42.

[49] Ibid., 143.

[50] Alejandro, Tapia., *Project Resourcefulness and Adaptability*, Interview by Maria Arrasate. Teleconference (2015)

[51] Mott MacDonald*., Hazardous Materials Spill Contingency Plan* (Nassau: 2001)

towards the limited water resources on the Island. While the monitoring of these efforts to protect the water supply were conducted within the broader scope of the environmental assessment by multiple monitoring authorities, documentation outlining 'water-specific' monitoring reports would highlight the significant impact the Transport Program had on the island. Quantitative and qualitative measuring of groundwater, and potable water availability would provide an important step in determining the balance of the Island's water consumption.

6. NATURAL WORLD CATEGORY

Natural World focuses on how infrastructure projects may impact natural systems and promotes opportunities for positive synergistic effects. Envision encourages strategies for conservation and distinguishes projects with a focus on enhancing surrounding natural systems. Natural World is further divided into three sub-categories: Siting, Land and Water, and Biodiversity.

Siting

The credits within the siting category promote an understanding of the living, contextual environment in which the infrastructure improvement project takes place. Addressing the negative or unwanted impacts these projects introduce on the environment, the category rewards the identification of sensitive surroundings along with mitigation efforts taken to support the diverse habitat resulting from the unique geological and hydrological features of the area. The NPTP achieved a notable performance in relation to the preservation of habitat but opportunities for improvement still remain for the preservation of floodplains.

The project team engaged in both the opportunities and challenges the geology of the island presented. Although not subjected to tectonic upheavals, caves and sinkholes represented risks to hydrology that were widespread on the Island.[52] To protect the groundwater from contaminated silt runoff, site drainage was intercepted and diverted into natural channels, infiltration ditches, and other areas of stable ground cover. Lined drainage systems facilitated discharge into the ground at levels below the freshwater lens, protecting it from pollution. Additionally, the natural, low lying topography of New Providence facilitated responsible development in matters of cut and fill, while bare embankments along roadsides were planted with native plants to provide protection against soil erosion and runoff.[53]

Alternatively, this topography created obstacles for overcoming in matters of surface water protection. Given that the infrastructure project inherently contributed to increased storm water runoff, the project team focused efforts to maintain pre-development floodplain storage.

[52] ESIA, 43.

[53] *New Providence Transport Program Environmental and Social Management Plan* (2008), 9.

Water bodies affected by alterations to existing drainage patterns were identified during preliminary design stages and consequently, maximum construction times and appropriate scheduling of works occurring within the floodplain were detailed into the contractor's schedule. The additional promotion of infiltration whenever possible further contributed to ensuring restoration times of sensitive areas were kept to minimum.[54] Further care for the geology was observed in the treatment of local Greenfields. As a mostly urbanized area, the extension of the road network augmented existing roadways, taking care that the limited Greenfields left were not compromised.

Beyond preservation, the NPTP demonstrated restoration efforts in the Big Pond Park. The improvement, initiated by the BEST Commission, identified the unique land as of high ecological value. Although once a landfill, and assessed as a brownfield, the decade of community interest in the project propelled a planning vision for the creation of a 181 acre habitat to serve the public through educational and recreational facilities[55]. Reversing the trend of habitat fragmentation that characterized the site, the revitalization project ensured an increase in the land value, successfully preserving the area for future growth and integration into community. Perhaps lacking, is an appropriate measure of what the project team was able to achieve. The possibility to observe pre and post-floodplain storage and elevations could demonstrate the significance of the investments made at the Big Pond relative to the larger scope of the road improvement project.

Land & water

Within the Land and Water category, the New Providence Transport Program demonstrated significant foresight in the impacts associated with the road improvement project. In doing so, preventative measures to mitigate against the effects of increased runoff, surface and groundwater contamination, and non-point source pollutants reached high levels of efficiency and widespread implementation.

With a geology characterized by low-lying and often featureless topography, the landscape was susceptible to groundwater contamination, and the hydrological disturbances associated with storm events, which required precaution. Environmental Management Plans, specific to each corridor location,[56] were prepared and subsequently audited to monitor their effectiveness, ensuring that concerns of groundwater pollution, soil erosion, and silt runoff were appropriately addressed.

With the lack of any horizontal drainage system underground, successful infiltration of water through the soil was done sensitively so as to avoid the possible contamination of the freshwater lens near the ground surface. To accomplish this, vertical drainage wells were widely used to promote the passage of water through the lens to the aquifer. Evidence of the

[54] .ESIA, 171.

[55] ICF Jones & Stokes., *Big Pond Park Implementation & Management Plan*. (Sacramento: 2010), 26

[56] ESIA, 203.

effectiveness of this measure was witnessed after significant rainfall events, as flooding was not observed where the wells had been installed.[57] Although the system passes the event-test, the opportunity remains to further demonstrate this significance through measured comparisons of infiltration and water harvesting capacities before and after drain installation.

Measures used along the corridors were extended into the remediation efforts of the Big Pond Park, where drainage ditches and channels which distributed water to retention areas were regularly inspected to safeguard water bodies against pollution.[58] To combat invasive species and support natural infiltration within the park, pesticides[59] and fertilizers are used only as needed to establish appropriate ground cover. Although operational and application policies of pesticides were compliant with local regulations, the project team could have done more to address the dangers associated with the over-application. Especially considering the tendency to over-apply can result from a desire to expedite a natural process causing water contamination by runoff.

Biodiversity

The negative impacts on adjacent wetlands, local species and indigenous wildlife – resulting from construction works - was of careful consideration from the outset of the project. Understanding the risks to native habitats as a result of the adverse effects of infrastructure projects of such a large scale, the New Providence Transport Program (NPTP) invested significantly in both preventative and restorative measures to protect and preserve the biodiversity of the affected areas.

The prevalence of wetlands throughout the island results in a thriving ecosystem that offers food, shelter, spawning, nesting and predatory opportunities.[60] Consequently, many of the NPTP's protective initiatives resulted from a desire to protect these areas through the restoration of disturbed soil, maintenance of existing drainage patterns, and the supporting of local flora and fauna through the elimination of invasive species. Particularly relevant were the actions undertaken for the restoration of Big Pond Park considering the outlined specific wildlife management measures for both the eradication of invasive species and protection of threatened and/or endangered wildlife.[61]

Additionally, strategic assessments were carried out prior to commencement of work to identify particularly sensitive corridors where species-specific management measures were carried out. Corridors 5, 7, and 8 exemplify targeted areas of concern, as they hosted significant bird populations and two areas of coppiced woodlands. Opportunities to plant along derelict land adjacent to project areas were also taken to provide sediment control while re-purposing the soil cover removed for the widening of roads.

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57 Tapia, Alejandro., Project Resourcefulness and Adaptability, Interview by Maria Arrasate. Teleconference. (2015)

58 ICF Jones & Stokes. *Big Pond Park Implementation & Management Plan* (Sacramento: 2010), 41.(hereafter cited as BP-IMP)

59 ESIA, 228.

60 ESIA, 53.

61 BP-IMP, 104.

The NPTP's most notable effort to support and in part restore the local ecosystem occurred at the Big Pond Park, where the functions of streams, wetlands, and waterbodies were positively impacted. Addressing mitigation measures for drainage, geology, hydrology, and terrestrial ecology, the Environmental and Social Impact Assessment outlined clear project objectives. Maintaining natural drainage patterns and rehabilitating surface water discharge reconnected previously fragmented[62] portions of the wetlands supporting the future proliferation of native species.

The project performed at high levels in regards to biodiversity, however, room for improvement remains in the assessment of disturbed soils. Characterized by limited soil depth across the Island, the importance of this resource was not lost on the project team as contractually displaced soil was required to be cleaned and reused.[63] However, whether or not 100% of the displaced soil was remediated and re-purposed is unknown.

7. CLIMATE & RISK CATEGORY

Envision aims to promote infrastructure development that are sensitive to long-term climate disturbances. Climate and Risk focuses on avoiding direct and indirect contributions to greenhouse gas emissions, as well as promotes mitigation and adaptation actions to ensure short and long term resilience to hazards. Climate and Risk is further divided into two sub-categories: Emissions and Resilience.

Emission

Promoting the understanding and reduction of dangerous emissions, including greenhouse gases and other dangerous pollutants, emissions considerations are taken to mitigate against both short and long term risks to the project. The New Providence Transport Program (NPTP) raises the issues associated with emissions in a general way but does not engage in the specifics necessary to determine total achievement at the scale of the project.

The road infrastructure project, initiated as a means to reduce congestion, inherently counted with opportunities to also influence the burning of carbon-based fossil fuels. With this in mind, it would have been prudent for the project team to carry out life-cycle carbon assessment prior to the commencement of work to be able to understand the impact alleviating congestion had on the release of greenhouse gases. Instead, the issue was understood as a long term problem[64] over which the project had little power of influence, as alleviated congestion would incentivize more automobile users, resulting in a canceling effect on any gains that had been

[62] ESIA, 3.
[63] Ibid., 41.
[64] ESIA, 41.

made through increased traffic flow.

The project does not differentiate between emissions generated during the extraction, processing, and transportation of materials and those resulting from construction. To the project team's credit, mitigation measures were perceived to be of more value implemented as policy measures that would increase the appeal of alternative forms of transportation, offsetting the emissions of operation over the long term.[65]

In the interest of public health, the reduction of air pollutants also figured among the NPTP's objectives. Measures mitigating against odors and dust were outlined during the preliminary stages of the project[66] while auditing occurred periodically during construction to ensure the practices specified in Environmental Management Plan were being followed.[67] While the Environmental and Social Impact Assessment outlined control measures in accordance with the Florida Department of Transportation, (FDOT) no specific benchmarks are outlined within the provided documentation that would assess other significant criteria pollutants such as: ground level ozone, carbon-monoxide, sulfur oxides, nitrogen oxides, and lead. In short, an improvement project of this type, which includes negative environmental impacts such as odors and emissions, should address these issues in depth. The opportunity remains for the Transport Program to investigate how pollutant source reduction might be achieved to improve ambient air quality.

Resilience

A resilient project is one that is able to withstand short and long-term risks, such as flooding, changing weather patterns, and changing climate.[68] For assessing and mitigating against potential threats, avoiding exposure of natural vulnerabilities, and preparing for long term adaptability through response programs and natural restoration, the New Providence Transport Program (NPTP) represents a resilient project yet maintains opportunities for continued fortification.

In assessing the threat of climate change, the project team passed on a considerable opportunity to address the reduction of greenhouse gases across the island. While the road improvement project had indirect impacts on emissions through alleviation of traffic, a climate impact assessment was not prepared which could have projected future changes in climate and ultimately informed an appropriate response.

Better accounted for were technical, environmental, financial, and socio economic risks to the project which carefully addressed the viability of the project in these terms. In one instance, studies addressing changing gasoline prices at a future time showed no measurable change in

65 ES, 2.

66 ESIA, 140.

67 Mott MacDonald. *Big Pond Urban Park Site Environmental Audit* (Southampton: 2014), 3.

68 ENV, 144.

project feasibility weighed against the project's economic internal rate of return.[69] Human induced hazards stemming from hazardous spills along roadways were also addressed though a spill contingency plan.[70] At the environmental level, the infrastructure project used the decentralized nature of the corridors to its advantage through redundancy in available routes, while using prevalent wetlands to manage and treat stormwater to protect against flooding.[71]

Most significant to the project's long-term adaptability were restorative efforts in identified areas sensitive to flooding. Preventative design measures consisted of vertical wells drilled to expedite water infiltration so as to prevent ponding and eventual flooding, while clearing and enhancement of the natural drainage patterns along roadsides adeptly managed the increased runoff resulting from newly constructed corridors.[72] This combination of risk assessment and strategic planning established emergency routes unaffected by hurricane events allowing distribution of resources to affected communities.[73] Delivering a design that anticipates, withstands, and adapts to risk, the NPTP ensured needs of the community will continue to be met, well into the future.

Room for improvement still remains for the project to address heat island effects resulting from paved roadway surfaces. Utilizing surface materials with a high solar reflectance index (SRI)[74] the team could boast a greater performance while acting in the community's best interest to mitigate against the high ambient temperatures that characterize the island during much of the year.

69 ES, 28.

70 Mott MacDonald., *Hazardous Materials Spill Contingency Plan* (Nassau: 2001)

71 BP-IMP, 3.

72 ESIA, 228.

73 Francis, Damian. *Project Overview* Interview by Maria Arrasate. Teleconference. (2015)

74 ENV, 152.