



CASE STUDY — Pisco, Peru

Strengthening Routing and Collection for Improved Waste Management

Case in Brief

Waste collection is fundamental to managing waste in cities and preventing that waste from reaching the ocean. Municipal governments have the responsibility to collect and properly dispose of waste; yet, many governments in low- to middle-income countries are challenged by limited institutional capacity and resources—financial, technical, and staff—to manage the collection in their growing cities.

In the coastal city of Pisco, Peru with a population of nearly 81,000, over 70 metric tons of solid waste are generated daily. Large quantities of waste are ending up in the sea—polluting the coastline and impacting tourism—due to inconsistent and inefficient collection practices and low recycling rates. The city lacks formal waste collection routes that cover the entire city, their large garbage trucks are unable to collect waste along narrow, dead-end, or deteriorated streets, and end up traveling longer distances, using more fuel, and generating more emissions. **To establish more dependable collection practices and mitigate ongoing impacts from the growing volume of waste, the United States Agency for International Development’s (USAID) Clean Cities, Blue Ocean program partnered with the local government in Pisco, Peru to develop a reliable and effective waste collection and routing system that is now serving previously unserved parts of the city, maximizing city resources by reducing the costs associated with duplicative routes, and decreasing the extent of street litter entering the environment and our ocean.**



At a Glance

2 billion

people worldwide still lack access to solid waste collection¹

With the optimized routes, the city of Pisco can collect an additional

12 metric tons

of garbage per day

¹ United Nations Environment Programme. 2015. Global Waste Management Outlook.

To improve efficiencies, new routing plans have been developed in all eight districts in Pisco, expanding waste services to 19 percent more of the population (nearly 12,800 additional residents) using the same collection vehicles—with the same workers in less time—and reaching 100 percent waste collection coverage. With the optimized routes, the city of Pisco can collect an additional 12 metric tons of garbage per day. The model that Clean Cities, Blue Ocean used to optimize routing and collection in Pisco can be tailored to other cities' unique contexts, and the program has initiated similar efforts in Sri Lanka, the Philippines, and Vietnam.



Clean Cities, Blue Ocean program staff verifying routes with city of Pisco operational staff.
Photo: Clean Cities, Blue Ocean

Background

Reliable waste collection is a core component of a functioning and efficient solid waste management system—a municipal service that prevents waste from leaking into the environment and reaching our oceans.

The World Bank estimates that low-income countries collect only about 48 percent of waste in cities.² In Pisco, uncollected waste is often managed at the household level. Methods can range from at-home and community composting to environmentally harmful approaches like open dumping and burning. Consistent, dependable collection is essential for building sustainable and livable cities, and reducing the amount of waste entering our waterways, but it remains a challenge for cities that don't have the resources—technical skills, financial resources, or staffing levels—to devote to waste management.

Most of Peru's coastal municipalities do not have formal routing systems for waste collection; and therefore, do not effectively serve their residents or optimize local resources. In cities such as Pisco, routes have developed organically over time with collection workers deciding schedules, frequency, and routes—many times at random, based on the driver's experience. Municipal trucks collect waste from the same streets in some neighborhoods as often as seven times per day, while other neighborhoods receive no collection services at all. There are often no controls imposed, and coverage depends on individual drivers with many workers starting as early as 4:00 a.m.—before anyone has put their garbage out. Pick-up times are inconsistent and trucks may make multiple and unnecessary passes at unpredictable times.

“Thanks to USAID's support we are restructuring the entire collection process. We have followed the routes for years, but there has never been a study to define optimal routes and to be efficient in the service, increasing collection coverage in different sectors. We want to provide a better service for citizens and for tourists to feel comfortable.”

– **Yesenia Segovia**

Former Manager of Services to the City, Environment and Public Safety of the Municipality of Pisco

² Kaza, Silpa; Yao, Lisa C.; Bhada-Tata, Perinaz; Van Woerden, Frank. 2018. What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050. Urban Development: Washington, DC: World Bank.

As Pisco has grown, methods for adding collection routes and schedules have not been adopted, resulting in residents and business owners disposing of garbage haphazardly, creating a growing number of waste hotspots across the city—areas where waste collection services are thin or non-existent. This situation causes unnecessary expenses for the municipality if they have to allocate additional waste collection shifts (garbage trucks, personnel, fuel) to collect additional waste.

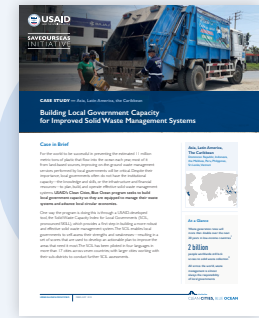
Many residents in Peru do not depend on or use municipal services to dispose of their waste because of the country's insufficient local waste collection systems. As a highly urbanized country with most of its population located in coastal areas, this means that plastic waste will easily find its way into the Pacific ocean. **In Pisco, over 70 metric tons of solid waste are generated daily—about 0.94 kg of waste on average per person—and 100 percent of that waste is disposed of in open dumps.** While the country imposes taxes for waste collection, between 60 and 70 percent of citizens don't pay or are late in paying—increasing the importance of local governments optimizing often limited waste management budgets.

Our Approach

As part of its local systems approach to building a circular economy, USAID promotes improved municipal waste services by supporting local governments to optimize waste collection routes. In the city of Pisco and other partner cities across the world, Clean Cities, Blue Ocean is providing technical support and local grants to strengthen waste collection systems and reduce plastic leakage into the ocean.

Solid Waste Capacity Index for Local Governments

As a first step in Pisco, the Clean Cities, Blue Ocean program worked closely with the local government to facilitate a [Solid Waste Capacity Index for Local Governments](#) (SCIL - pronounced "skill") assessment, a USAID-developed tool that helps local governments self-assess their capacity to develop, plan, and operate an effective solid waste management system. An important outcome of the SCIL process is for city staff to develop an actionable plan with a prioritized set of recommendations that they can reasonably implement with available resources. In Pisco, the SCIL prioritized three recommendations: improving service collection and routing, increasing community participation, and involving the informal waste sector in the waste management planning process. Based on the SCIL assessment, Clean Cities, Blue Ocean supported the city to optimize solid waste collection routes across all of Pisco.



The SCIL provides a methodical and distilled, yet comprehensive, approach for local governments to easily assess their capacity. In a SCIL assessment the following six areas are assessed and scored:





Early Stakeholder Engagement

Neighborhood committees in each of Pisco's eight districts actively participated in redesigning the waste collection routes, in close coordination with local government departments with management authority over waste collection.

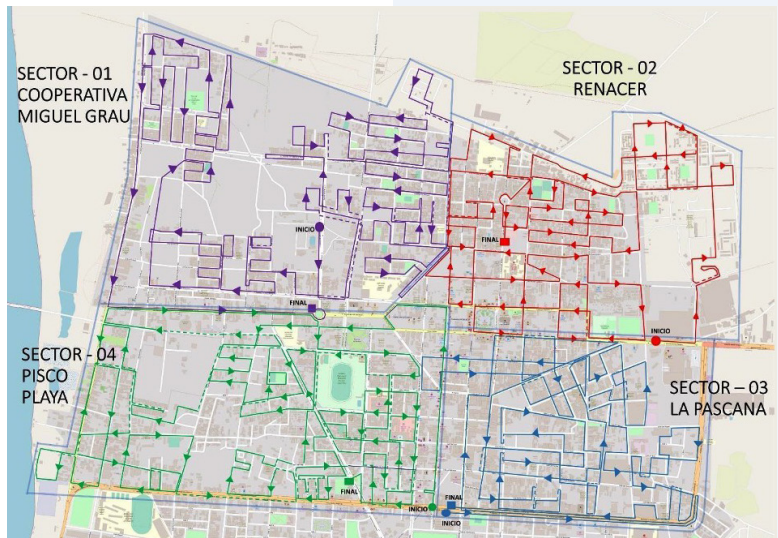
To initiate stakeholder coordination, a workshop was held to understand the specific challenges facing each of the various local government departments around waste collection and recycling rates. JUVDELES neighborhood committees—the Local Development Neighborhood Board that is formally recognized to promote effective neighborhood participation in the district—were engaged to provide feedback and facilitate community awareness. Other various government departments included the Management of Services to the City, Environment and Public Safety; Municipal Environmental Sub Management; Public Cleaning Office; Sub Management of Transport and Road Safety; and Public Relations and Institutional Image Unit.



Data Gathering, Analyzing, and Route Design

The next step involved analyzing existing collection routes for each area to better understand the challenges, the amount of waste collected, and to identify any waste hotspots or underserved areas. Optimizing collection routes is complicated and requires the consideration of multiple factors, including: one-way and small streets with limited truck access, congested commercial areas, and waste hotspots requiring more frequent collection. Information was gathered on the collection equipment available (quantity, type, and condition); the number of daily trips and the distance traveled for each vehicle; and the time per trip. The roads and peak hours of congestion in each area were analyzed, in addition to any roads that presented difficulties for the transit of large garbage trucks (e.g., due to low electrical wiring, narrow streets, dead-end or deteriorated streets, construction work, or steep slopes).

Combining this analysis of the city's waste situation with additional data—collected using alternative technical solutions such as Google Earth and cell phones—the city's technical and operational authorities were able to create new more efficient routes. The new routes factored in routing best practices such as minimizing left-turns (in Peru, the direction of circulation is to the right) and U-turns; the start and end locations (i.e., from the garage to the final disposal site); streets slopes; and peak traffic hours; among others.



Proposed optimized solid waste collection routes in four areas in Pisco city that minimize left-turns and U-turns.

“This is a great task that we have—in this signing of strategic alliance agreements—in search of a clean city and a clean sea for all Peruvians, for all the people of Pisco.”

– Lic. Juan Enrique Mendoza Uribe

Mayor of Pisco

Clean Cities, Blue Ocean program launch in Peru on November 21, 2021



Local waste collectors tracking the collection routes in Pisco, Peru.
Photo: César Velarde/
Clean Cities, Blue Ocean



Data Verification

Once the optimized collection routes were completed, they were validated in the field by municipal staff who made additional suggestions that were included in the design. A workshop was held to train staff on the new collection routes before initiating a trial period (or “dry run”) of the new routes with the collection trucks. During the trial period, municipal staff verified the new routes and made additional suggestions, which were taken into account.



Communication Outreach

With USAID’s support, the municipal government developed a communication outreach strategy that involved meeting with residents and distributing banners and announcements from municipal trucks to communicate the details and benefits of the changes in services. Public involvement efforts were initiated early in the process and involved soliciting public input on the waste collection routes; and also implementing a multi-media awareness-raising campaign based on strategies developed in the workshops. Residents were informed about the changes in waste collection schedules and routes—that the garbage truck would only pass their homes once at a set time—as well as the fines imposed by the municipality if they did not comply.



Managing Adaptively

Collection routes, even after being optimized, require close monitoring and necessary updates, based on changes in the cities’ solid waste management system. For example, it is expected that USAID’s support in the formation of a recyclers association in



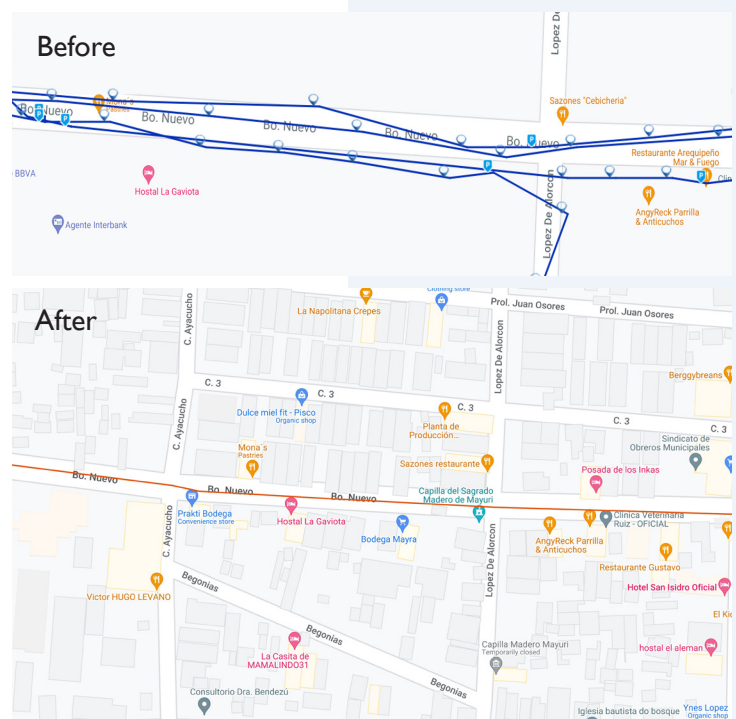
The communication outreach strategy deployed informative panels that were strategically placed on city streets.

Voice messages were also recorded and broadcast through loudspeakers by vehicles that drove through the streets before and during testing of the new waste collection routes. The municipality continues to broadcast messages to city residents.

ABOVE
An example of the banners placed on city streets.
Photo: César Velarde/
Clean Cities, Blue Ocean

Pisco, will decrease the amount of waste to be collected, which will require modifications to the collection routes. The municipality is currently working to develop an ongoing monitoring and evaluation system for the optimized collection routes and requested USAID support.

Central to designing optimized collection routes involved engaging representatives of the JUVDELES, the Local Development Neighborhood Board, and the neighborhood councils to understand the public's perception of waste collection and their needs. Community engagement is ongoing—even after the routes are established—to ensure waste collection services are adequate, that community members are following new guidelines, and that the routes are meeting the needs of the residents.



Comparative detail showing the number of times the garbage truck passes through a street, before and after route optimization along Barrio Nuevo Street.

The model Clean Cities, Blue Ocean used to optimize waste collection and routing can be applied and tailored to rapidly developing cities around the world. Using this model, USAID is improving waste collection in the Peruvian cities of Paita and Máncora as well as in additional focal countries:

- **In Sri Lanka,** Clean Cities, Blue Ocean supported the Municipal Council of Jaffna to optimize waste collection operations among 27 wards of the city after its 27 collection vehicles were reduced to nine because of fuel and resource shortages. The optimized routes will be piloted in April 2023. In Galle, Clean Cities, Blue Ocean facilitated a workshop for city officials to map their collection routes, which were later digitized, and optimized routes were piloted in March 2023 in one zone. Results were shared with mayors and councilors, which helped the senior officials restructure their waste collection zones and determine the exact cost of collection for the municipality.
- **In the Philippines,** Clean Cities, Blue Ocean initiated discussions with local government partners to strengthen waste collection operations in several cities. In Puerto Princesa City, the program worked with non-governmental partners to establish a new, optimized collection and routing schedule, serviced by local informal waste collectors, to improve city waste collection services.
- **In Vietnam,** Clean Cities, Blue Ocean completed a solid waste management assessment, including mapping collection routes, to better understand the local context and the waste management challenges and determine appropriate technical support.

Impact

The city of Pisco, Peru optimized routing and collection plans for all eight areas of the city. Garbage trucks now reach all neighborhoods for the first time; the city is cleaner, with fewer opportunities for waste leakage; and residents' health is better protected.

Tangible benefits as a result of the new routes include:

- **Expanding coverage while improving efficiencies**

Pilots for the optimized routes began in August 2022. Six months later, the new routes were fully operational in all eight areas in Pisco and have expanded waste services to nearly 12,800 additional residents using the same collection vehicles—with the same workers, in less time—and have achieved 100 percent waste collection coverage for the entire city. Increased routing efficiencies also results in fewer municipal resources expended.

- **Reducing street litter**

As more households and establishments are reached with collection services—especially in distant neighborhoods—less waste is scattered in city streets that can leak into the environment.

- **Minimizing climate impacts**

With the new routes in place, the distance garbage trucks need to travel decreased by almost 68 percent—and associated idling time; and the distance traveled from the end of the route to the dump decreased by almost 14 percent. More efficient routes also resulted in a reduction in greenhouse gas emissions equivalent to 93.5 metric tons of CO₂ per month or the equivalent of nearly 235,000 miles driven by an average gasoline-powered passenger vehicle.

- **Enabling broader system change**

More efficient routing in Pisco has resulted in residents' trust and accountability in the local government's capacity as evidenced by residents' feedback. Reliable collection has also enabled the foundation for a more holistic solid waste management system, including the promotion of recyclable initiatives in households, businesses, markets, schools, and other large waste generators such as hotels.



By the Numbers

19%

more residents reached in Pisco with waste collection services, using the same resources (collection trucks, personnel) in less time

35%

more territory covered by garbage trucks in Pisco, decreasing overall unproductive travel distance by almost 68 percent

ABOVE
Trash collectors picking up waste along new collection routes in Pisco, Peru, optimized through USAID's support to identify and improve critical gaps in local waste management.
Photo: Clean Cities, Blue Ocean

Key Recommendations

USAID's support in Pisco to optimize routing and waste collection services focused on the early and ongoing participation and program ownership of local governments and communities, making efficient use of various data collection methods, and being aware of and responsive to limited local resources.

Prioritize engagement with local communities

In Pisco, the government prioritized soliciting community input to gain acceptance of the updated waste collection routes and included the development of a community outreach plan to communicate the changes as one of the critical steps in the process.

Collaborate with multiple local government departments

A considerable amount of time and effort is needed to coordinate with the various local government authorities involved in waste management to ensure their buy-in and support.

Use existing resources and available data to determine new routes

To develop new collection routes, the use of existing resources such as historic collection data, household information, and detailed GPS routing, can be helpful to validate collection volumes. For example, in Pisco, the government used Google Earth to count houses and cross-referenced that information with local population data and per capita generation of solid waste to estimate the volume of waste to be collected.

Identify innovative and less expensive solutions

Particularly in small cities with limited resources and reduced budgets, look for innovative and less expensive ways to implement optimization—for example, identifying waste hotspots to maximize waste collection.

Related Resources

USAID's SCIL Toolkit consists of the SCIL Assessment Implementation Guide, an Excel-based assessment tool, an SCIL orientation presentation, and SCIL survey preparation documents. The toolkit is also accompanied by a six-part SCIL Primer—a preparatory training series to familiarize local governments with the assessment components and their importance and expand awareness and use of the assessment.



[Download accompanying SCIL Toolkit components](#)

SCIL Assessment Tool
SCIL Factsheet
SCIL Assessment Implementation Guide
SCIL Orientation Presentation
SCIL Primer

SCIL Surveys

1. Planning
2. Policy and Legal
3. Financial Management
4. Service Delivery
5. Community Engagement
6. Human Resources

[Clean Cities, Blue Ocean in Peru](#)

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