



Design to Save Lives

Transforming
LeGare Intersection
in Addis Ababa





ADDIS ABABA CITY GOVERNMENT
TRANSPORT PROGRAMS MANAGEMENT OFFICE
In front of AU head quarter, Yotech building 3rd – 6th Floor
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Global
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Initiative



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BACKGROUND



Objectives

The BIGRS program includes the following objectives.

Data Collection

Enhancing data collection practices and actively monitoring road user behavior and traffic crash data.

Media and Communications

Pursuing mass media campaigns to build awareness around risk factors for road crashes including helmet use, speed reduction, drink-driving prevention, and seat-belt use.

Enforcement

Promoting police enforcement of motorcycle helmet wearing, speeding, drink-driving, and seat-belt use.

Safer Streets and Mobility

Promoting safe streets and safe mobility options. This includes updating policy and guidance, conducting road safety audits, redesigning streets to improve safety, and promoting sustainable mobility choices.

Program Overview

In 2014, Bloomberg Philanthropies launched the Bloomberg Initiative for Global Road Safety (BIGRS), committing \$125 million over five years (2015-2019) to 10 cities. In addition to Addis Ababa, the other BIGRS cities include Fortaleza (Brazil), Bogotá (Colombia), Accra (Ghana); Bandung (Indonesia), Bangkok (Thailand), Ho Chi Minh (Vietnam), Mumbai (India), São Paulo (Brazil), and Shanghai (China).

Each BIGRS city receives technical assistance and resources to pursue policies and projects that reduce fatalities and injuries from road traffic crashes. The program brings together leading experts on road traffic safety around the world.

In addition to international technical support, the BIGRS program supports embedded staff in each city. This local staff oversees day-to-day management of the BIGRS program and supports coordination between international experts and local implementing agencies. In Addis Ababa, embedded staff sits at the Transport Programs Management Office (TPMO) and include the following positions:

- Bloomberg Initiative Coordinator,
- Road Safety Lead Engineer for Road Design and Transportation,
- Road Safety Coordinator for Road Policing,
- Surveillance Coordinator, and
- Communication Coordinator

Partners

Seven global partners support the BIGRS program.

Data Collection

John Hopkins University - Bloomberg School of Public Health and Vital Strategies

Media and Communications

Vital Strategies

Enforcement

Global Road Safety Partnership (GRSP)

Safer Streets and Mobility

WRI Sustainable Cities, The Global Designing Cities Initiative at the National Association of City Transportation Officials (NACTO-GDCI); the World Bank's Global Road Safety Facility; and the International Road Assessment Program (iRAP).



EXECUTIVE SUMMARY

Addis Ababa is committed to improving road safety and reducing traffic injuries and fatalities around the city. One key strategy for improving road safety is through street design. In order to test design approaches and build support for permanent design interventions, the city transformed LeGare intersection in December 2016.



Over 100 people from five city agencies and three academic institutions were involved in transforming the intersection



using 750 liters of paint



and 120 planters and bollards, to reclaim over



2,000 square meters of underutilized space.

This document provides an overview of the transformation process and presents preliminary findings from the experience. Below are some of the key takeaways detailed in this report.

- **Fatal crashes decreased.** Crash data comparison shows a reduction in the number of serious and fatal crashes before and after the transformation, and an overall reduction in the severity of the crashes. In the six months after the intervention, there were no pedestrian fatalities and only one slight pedestrian injury compared to one fatality and two serious injuries in the six months prior to the intervention. While these findings are preliminary, and additional data collection is necessary, they are promising.
- **Crossing distances were reduced** from 50 meters (m) to a series of shorter crossings (9.5 m and 6.5 m) linked by refuge islands. The turning radii were reduced to 6.5 m, slowing vehicle travel speeds while still allowing for articulated buses to turn smoothly.
- **Driver behavior became more predictable.** A key goal of the transformation was to repurpose disorganized road space, which was contributing to congestion and speeding. By aligning the travel lanes coming in and out of the intersection, motorist movement became more predictable and efficient.
- **Average turning speeds decreased**, thus reducing likelihood of crash injuries and fatalities. Before the transformation, average turning speed was over 30 kilometers per hour (km/hr). With the updated alignment, speeds reduced to around 18.5 km/hr.
- **Pedestrian sidewalk and crosswalk compliance increased**, thus reducing exposure to crash risk. By adding crosswalks and other markings in line with desire lines, pedestrians naturally gravitated to the designated space.
- **Pedestrians felt safer.** User surveys revealed that the majority of pedestrians felt safer and more comfortable in the transformed LeGare intersection: more than 70 percent of those surveyed felt safer, and almost 65 percent expressed a desire to see the interim transformation become permanent.

LeGare Transformation Phases

Top: Before the intervention

Middle: Pop-up intervention (June 2016)

Bottom: Interim transformation

(December 2016 - May 2017)

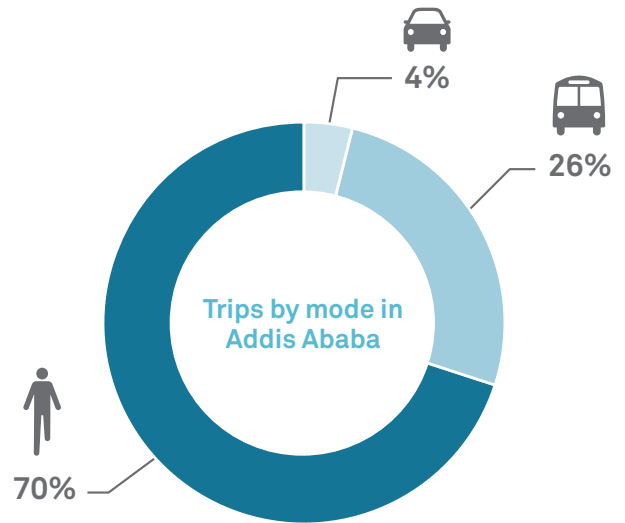
ROAD SAFETY CHALLENGES IN ADDIS ABABA

In 2016, more than 462 people died; 2,085 were seriously injured, and another 1,491 suffered slight injuries due to road crashes on the streets of Addis Ababa.* Each year, around 80 percent of road deaths in the city are pedestrians.

Street design in Addis Ababa has taken a car-oriented approach, prioritizing vehicle speed over pedestrian safety. Streets in the city tend to be wide with large turning radii. They lack sidewalks, crossings, and traffic calming features. Signal timings at major intersections sometimes exceed three minutes, encouraging dangerous road behavior such as speeding and jaywalking. Lane misalignment causes bottlenecks and unpredictable vehicle movement, while street markings and signage at and around intersections are inadequate. Finally, a lack of dedicated transit lanes and loading areas creates unsafe conditions for transit riders, and adds to congestion.

Partners from the Bloomberg Initiative for Global Road Safety studied 27 intersections around the city and found that implementing pedestrian-oriented designs can dramatically improve safety on the streets of Addis Ababa.

LeGare intersection has long been a hotspot for road crashes, with more than 80 crashes recorded between June 1, 2016 and November 30, 2016. Given its poor safety record and high pedestrian volume, LeGare was chosen for the first temporary intervention in the city.



Only four percent of trips in Addis Ababa are made by car. Around 26 percent of trips are made by public transit, while pedestrians account for 70 percent of total mode share. Considering that all transit riders must also be pedestrians at some point in their journey, Addis Ababa's streets must be designed to accommodate walking.

Each year, around 80 % of road deaths in the city are pedestrians. Pedestrian-oriented designs can dramatically improve safety on the streets of Addis Ababa.

* Addis Ababa Police Commission, 2016.



Without designated transit stops, passengers board in the roadbed.



Addis has many transport modes, but the vast majority of trips are made on foot.



Lack of frequent and well-marked pedestrian crossings encourages jaywalking.



Navigating Addis Ababa's streets is particularly challenging for the elderly and disabled.

TRANSFORMING LEGARE: PROCESS AND STRATEGIES

In July 2016, NACTO-GDCI conducted a pop-up intervention at LeGare as part of a capacity building session to train local stakeholders on street design strategies and metrics collection. The intersection geometry was transformed using chalk, string, and plants borrowed from a local nursery. Lanes were aligned to shorten crossing distances and lower vehicle turning speeds. The successful one-day trial helped gain support from local officials to pursue a six-month interim intervention. In December 2016, a longer-term design was implemented.

Implementing partners

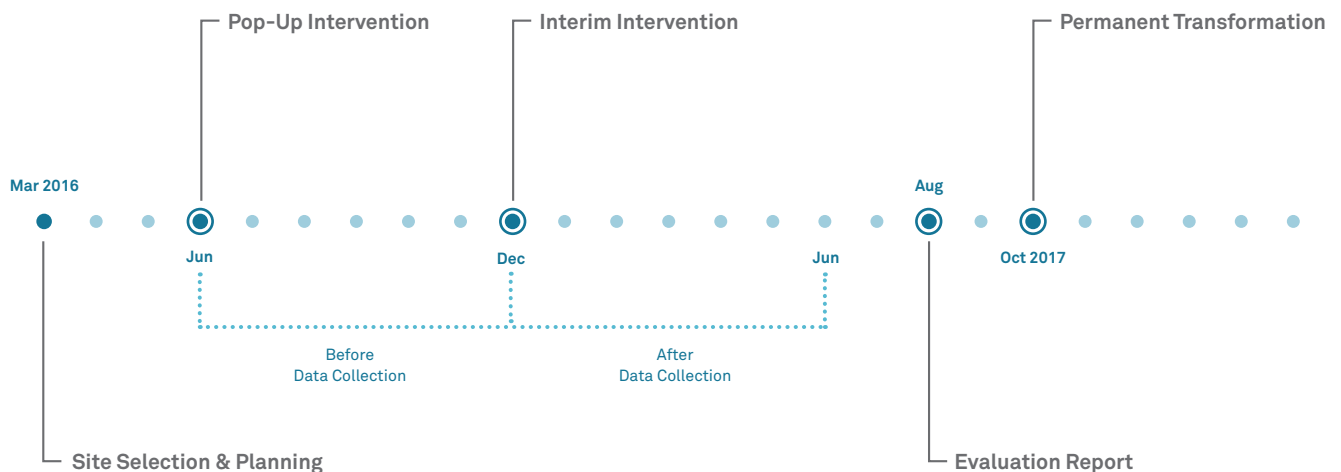
The project was made possible with the work of over 100 people from five city agencies, three local academic institutions, and community cooperation. NACTO-GDCI and Vital Strategies, working with BIGRS embedded staff, provided support for implementation.

Materials used

The interim transformation was realized using approximately 750 liters of paint and 120 planters to reclaim almost 2,000 square meters of public space and install four new pedestrian crossings. Median refuge islands and curb extensions were used to reduce crossing distances from one 50-meter crossing distance to two shorter crosswalks of less than 10 meters each, with a refuge space in between.

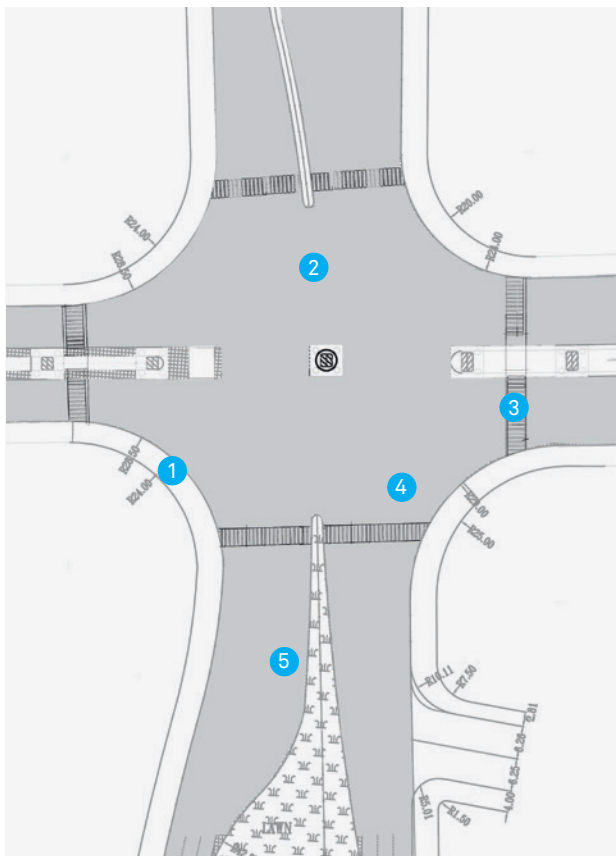
Key strategies

The LeGare redesign kept all existing travel lanes but reclaimed under-utilized space that encouraged motorists to travel at unsafe speeds. The more compact redesign helped to slow vehicular speeds, encourage lane discipline, and promote safe driving practices. Pedestrian crossings with stop lines were designed to align with pedestrian desire lines and the existing sidewalks. New curb extensions shortened crossing distance, thereby reducing pedestrian exposure to risk. Reclaimed spaces adorned with art provided designated areas for vendors. Finally, the right-turn lane (from LeGare to Behrawi) was tightened to slow traffic turning speeds and protect pedestrians.



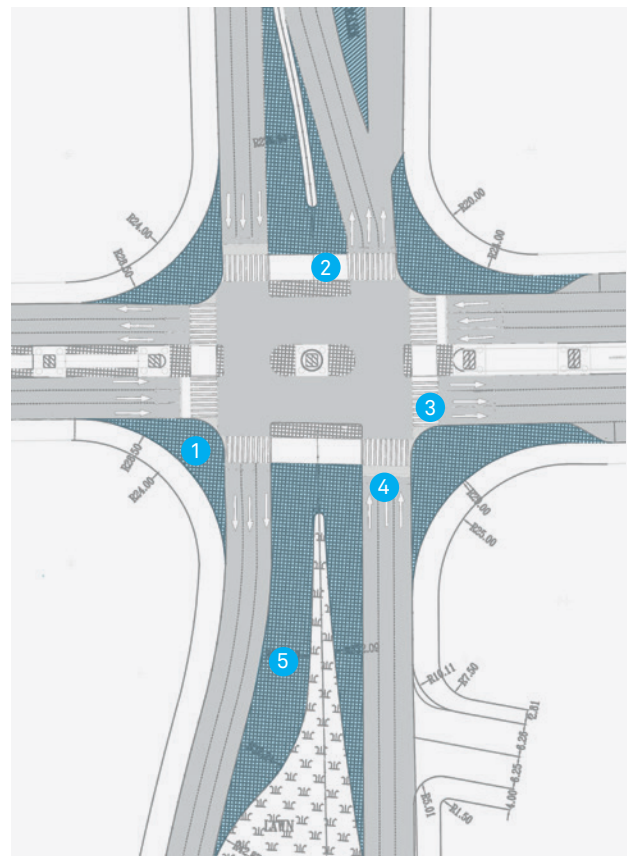
Simple design interventions can change the way pedestrians, cyclists, and motorists interact with the street environment. Before the intervention, the design at LeGare intersection provided little space for pedestrians and encouraged speeding. After the intervention, cars moved more predictably and pedestrians had safe spaces to cross and rest.

Before



- 1 **Large turning radii** that allow for gradual instead of sharper turning encourage motorists to speed.
- 2 **Long crossing distances** leave pedestrians vulnerable and can be particularly challenging for those with impaired mobility to cross.
- 3 **Recessed crosswalks** that are not aligned with pedestrian desire lines encourage jaywalking.
- 4 **Misalignment of lanes** creates bottlenecks and congestion.
- 5 **Underutilized road space** creates confusion for motorists and makes movement less predictable.

After



- 1 **Tighter corner radii** that require drivers to take a sharper turn help to slow turning speeds.
- 2 **Refuge islands and medians** shorten crossing distances and provide safe spaces for pedestrians.
- 3 **Direct crosswalks** that are aligned with pedestrian desire lines help to shorten crossing distances.
- 4 **Aligned lanes** help to ensure cars move smoothly and predictably.
- 5 **Reclaiming underutilized road space** keeps drivers in line and provides more space for pedestrians.

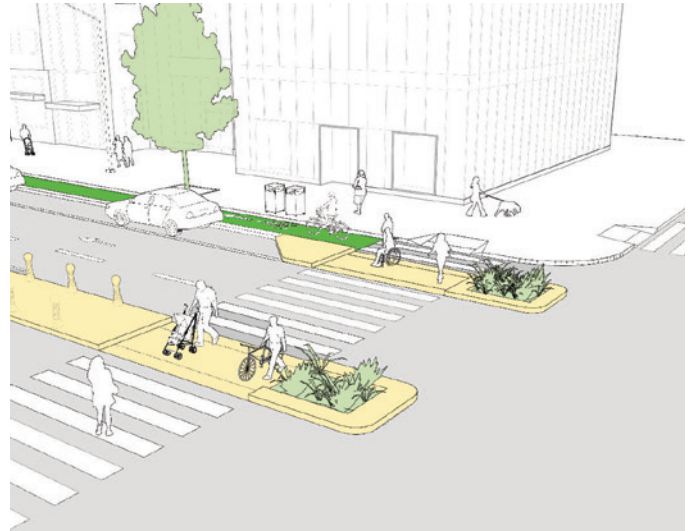
DESIGN STRATEGIES

Reduce Corner Radii



Narrow corner radii reduce pedestrian crossing distances and slow vehicle turning speeds. Minimizing the size of a corner radius is critical to creating safe and compact intersections.

Add Medians and Refuge Islands



Raised center medians and pedestrian refuge islands can be used to reduce lane width for vehicles, even on relatively narrow streets. They can also be used to organize traffic at intersections or to block vehicle access.

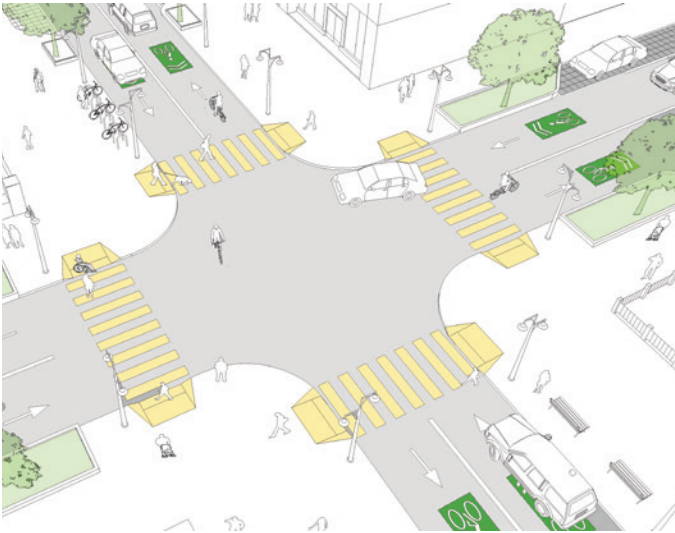


At LeGare, the turning radii was reduced from 16m to less than 7m, still allowing for large buses to turn at safe speeds.



At LeGare, refuge islands have been used to provide safe spaces for pedestrians and reduce crossing distances for all.

Create Direct Pedestrian Crossings

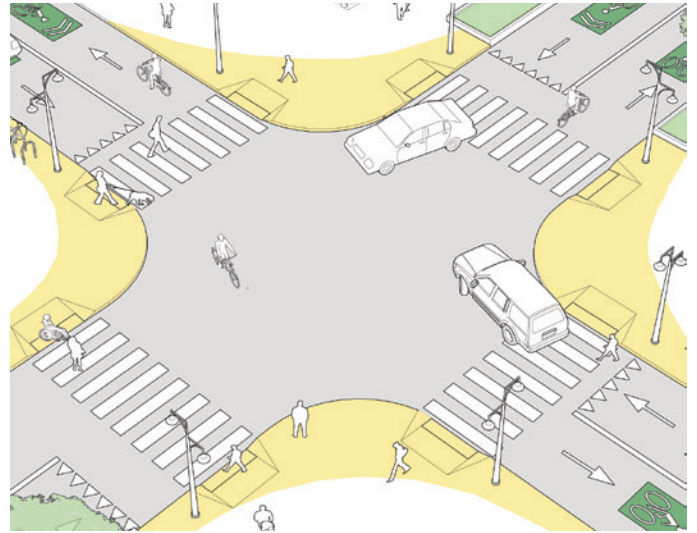


Pedestrian crossings should be aligned with pedestrian desire lines. Inconvenient deviations create an unfriendly pedestrian environment.



The transformation added additional direct crossings at each leg of the intersection, along with stop bars.

Align Travel Lanes



Compact intersections increase visibility for all users. Alignment of lanes coming in and out of an intersection encourages to manage efficient movement of traffic.



The lanes at LeGare were aligned to make vehicular movements more organized and reduce points of conflict. Reclaimed roadbed space was transformed to provide refuge for pedestrians.

INTERIM INTERVENTIONS

Changing decades of embedded practice in urban street design is a challenge. A lack of proven local precedents, limited funding, and regulatory restrictions can create barriers for innovative solutions. Interim interventions allow cities to test ideas in a flexible, low-cost way.

Interim elements and materials

As cities develop, street uses change and original designs may no longer meet user needs. Inexpensive and non-permanent solutions, including those listed here, can be quickly and easily deployed to change a city's streetscape.



Flexible bollards in Bogota help to keep vehicles out of the bike lane



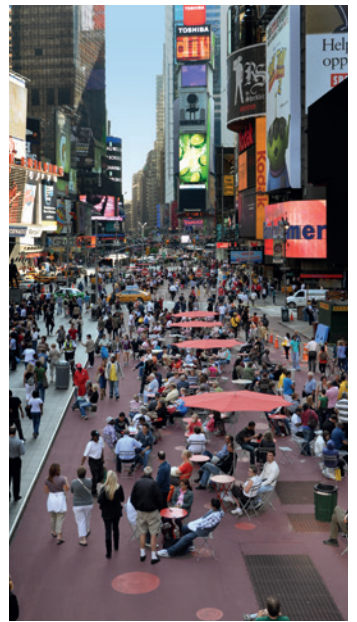
Spherical bollards in a public plaza in New York City

Bollards

Bollards of many shapes and sizes can help to delineate space, direct traffic flow, and protect pedestrians.

Paint and thermoplastic
Surface materials act as visual devices to guide driver behavior.

Since they do not create a physical barrier, they should be combined with other elements where appropriate.



Paint and street furniture were used to transform Times Square in New York City

Modular curbs

Small concrete dividers or rubber bumpers can be installed overnight to dramatically improve pedestrian safety.



A rubber platform provides safe space for passenger boarding in New York City



Concrete curbs provide protection for pedestrians.



Planters protect pedestrians and cyclists from motor vehicles and also make the streetscape more pleasant.

Planters

Planters can be used to define medians, islands, curb extensions, plazas, footpaths, and cycle tracks while also making streets more attractive.

Repurposing road space

Reclaiming and repurposing road space to better balance street uses can transform how a street functions, looks, and feels. The following options have been used around the world to transform streets to make them safer and more convenient for sustainable mobility choices.



Paint is used to widen sidewalks and add a mid-block crossing in Mexico City

Sidewalk widening
Sidewalks can be expanded using epoxied gravel, paint, planters, and/or bollards, providing additional pedestrian space in advance of full reconstruction.



Sidewalk widening in Seattle creates space for pedestrians and street furniture.



Paint makes pedestrian areas more visible to drivers in San Francisco

Traffic calming features
Traffic speeds can be reduced using paint and plastic bollards to create curb extensions at mid-block crossings or at street corners.



Vendors on a wide sidewalk in New York City.



Vendors in a street market in Accra.

Vendor stands and carts
Vendors provide food and other services where they are lacking. Cities around the world have repurposed parking spaces near transit stations and other popular destinations to provide space for vendors.

Parklets

Parklets provide curbside public seating in place of car parking. They serve as a gathering place and support economic activity.



Parklets provide space for pedestrians to rest, people-watch, or visit with friends

TRANSFORMATION COST

Pedestrian safety improvements are very cost effective. The cost of a vehicle underpass costs around 200 million Ethiopian Birr (ETB) while a pedestrian bridge in Addis costs around 10 million ETB. By comparison, the LeGare intersection intervention cost less than 400,000 ETB.



Interim interventions in cities around the world have demonstrated that temporary transformations can have a huge impact without requiring major investment. In New York City, for example, the cost of painting bike lanes, plazas, and other interim interventions was about one percent of the entire capital budget.

Temporary transformations are an interim step toward permanent construction; they allow agencies to trial new design ideas and strategies before investing in permanent reconstruction. They also demonstrate how materials other than concrete can be used to make streets safer and more pleasant. City authorities around the world are finding that allocating a small portion of capital budgets to support interim interventions can support significant improvements in safety and livability and build public support for investment.

For the cost of one underpass, the city could make 500 intersections across Addis Ababa safer and more efficient.



Artists from Addis Ababa University painting at LeGare Intersection.

ECONOMIC BENEFITS

Road injuries and fatalities carry a substantial social cost. Investment in road safety promises to dramatically reduce this cost. While additional data on injuries and fatalities will need to be collected before conducting a comprehensive cost benefit analysis, initial results are promising.

Economic value of road crashes in Addis Ababa (2016)

SEVERITY	QUANTITY	UNIT COST (ETB)	TOTAL (ETB)	TOTAL (USD)
Death	462	1,860,035	859,336,170	36,739,625
Serious injury	2,085	465,008	969,543,243	41,451,363
Slight	1,491	2,000	2,982,000	127,490
Total			1,831,861,413	78,318,479

In the six months before the intervention, there was one recorded death at LeGare intersection. There have been no road fatalities since the transformation, and serious injuries have declined 50 percent. While an increase in minor injuries has been observed, it is mostly limited to vehicle on vehicle collisions. Other crashes have been limited to property damage, which is economically less significant than the loss of life or a lifetime disability caused by serious injury.

For economic analysis, the value of life can be estimated by per capita income \times 100 (McMahon, 2008 and iRAP, 2010). In 2016, per capita income in Ethiopia is ETB 18,600 (United States Dollar (\$) 795). Thus, the value of life was estimated to be ETB 1,860,035 (\$79,523). Likewise, the social cost of a serious injury on the road could be estimated as 25 percent of the value of life estimate (see McMahon, iRAP 2010). Thus, the value of serious injury was estimated to be ETB 465,008, (\$19,880).

Using these values, the net benefit of the LeGare transformation was calculated to be ETB 2,294,268 (\$98,143)- almost seven times greater than the project investment cost (ETB 339,578).

As the table on this page shows, road crashes have a huge economic impact in Addis Ababa each year. If the city continues with these intersection upgrades and succeeds in reducing road fatalities, the economic benefits will be significant.

DATA COLLECTION & EVALUATION

The team collected a considerable amount of primary and secondary data to measure the impact that the transformation had on safety indicators.

Primary data was collected at LeGare intersection immediately before and shortly after the transformation. Surveys were conducted on weekdays and weekends over three peak-hour periods: 9:00 am – 10:00 am, 1:00 pm – 2:00 pm, and 6:00 pm – 7:00 pm. In all cases, hours of observation, day of week, and weather conditions were recorded for consistency and comparison. Metrics gathered include the following.

Pedestrian counts at sidewalks

Pedestrian counts included people on sidewalks and the roadbed. Surveyors simultaneously collected data at all four legs of the intersection to get a sense of pedestrian volume and sidewalk compliance.

Pedestrian count at crosswalk

Pedestrian crossing behavior was observed and coded based on the number of users inside the crosswalk during appropriate signal, inside the crosswalk without signal, and outside the crosswalk.

Vehicle counts

Vehicle counts were conducted and distinguished based on vehicular classification. Similar to the sidewalk counts, surveyors collected data at all four legs of the intersection.

Turning speeds

Vehicle speeds were collected at the four corners of the intersection using hand-held speed radar devices. Surveyors focused on documenting turning speeds to help understand pedestrian exposure to risk. These speeds were classified based on vehicle types.

Road user survey

Road users were surveyed to collect general demographic information and trip purpose, as well as perception on safety and comfort at LeGare. Surveys were collected before and after the transformation.

Road crashes

Data on road traffic crashes and fatalities was collected from the Kirkos Sub City Police Department and included: date, time, day of week, gender of drivers, age of drivers, educational status of drivers, relationship with the car, type of vehicle, owner of vehicle, road type, lighting condition, weather condition, severity, type of crash, and vehicle movements. The “before” data included incidents from June 1, 2016 through December 1, 2016. The comparative “after” data was collected from December 2, 2016 through May 31, 2017.



Students from Addis Ababa University collecting pedestrian and vehicular counts, as well as user intercept surveys.



Survey forms are used to capture key metrics.

Pedestrian Compliance

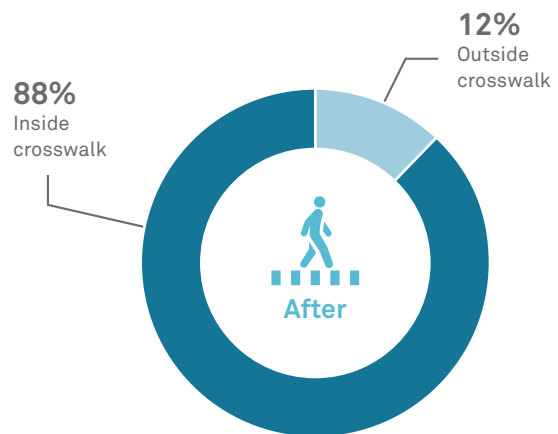
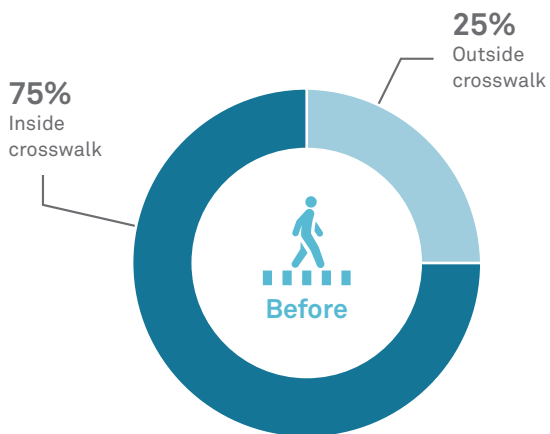
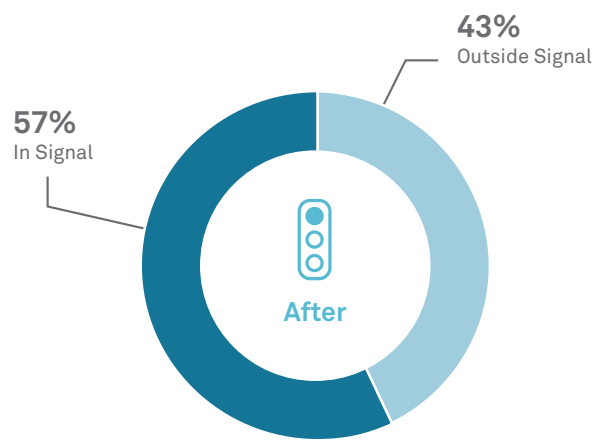
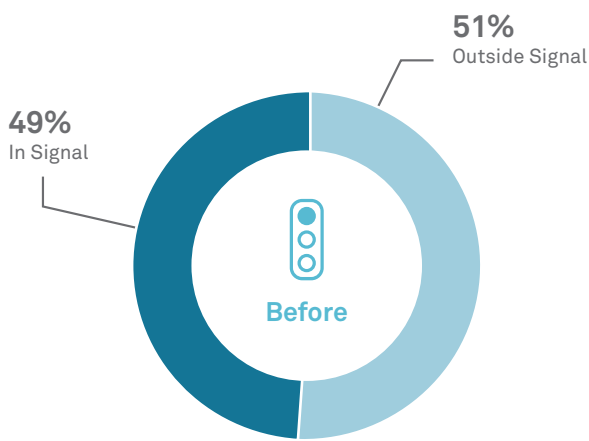
Before the transformation, more than 50 percent of pedestrians were walking outside the signal phase, and around 25 percent were crossing outside the existing-recessed crosswalk. After the transformation, the number of pedestrians complying with the signals increased by about 8 percent, and crosswalk compliance increased by 13 percent.

Long pedestrian crossing distances and the absence of a dedicated pedestrian signal phase encourage non-compliance, thus increasing crash exposure risk. Signal cycles at LeGare exceed three minutes, encouraging impatient motorists to

encroach on pedestrian space, speed when lights turn green, or generally disregard signals. Further, pedestrian signals at LeGare are too short. Surveyors found that users were only able to make it halfway across the wide road due to the free right-turning traffic moving at high speeds.

Even without changes to signal cycles, pedestrian compliance improved. Physical changes in street geometry must be pursued alongside signal improvement, effective enforcement, and public outreach.

Pedestrian crossing compliance at LaGare intersection

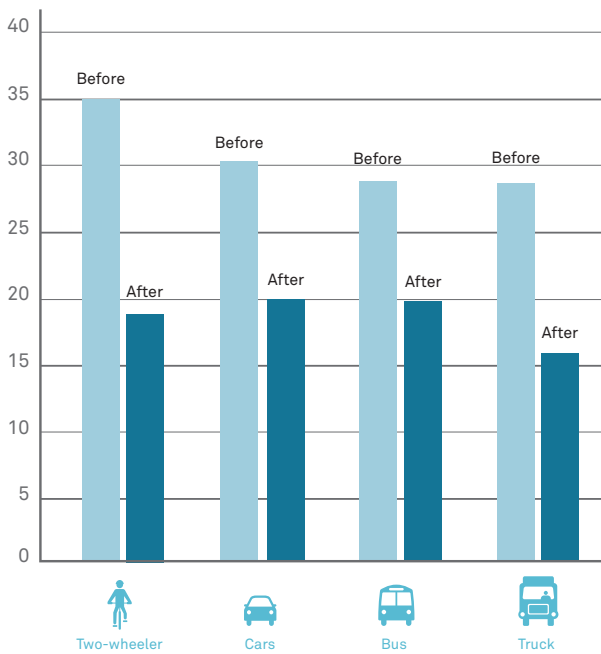


Turning Speeds

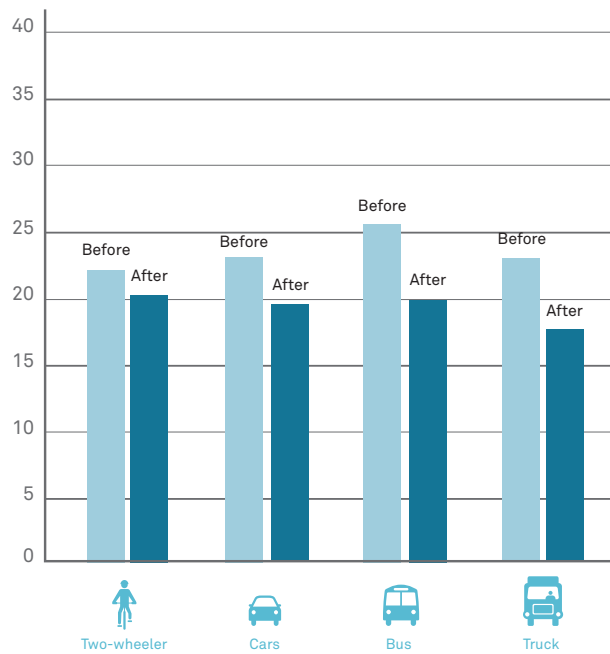
Studies show that the risk of death is below five percent for crashes at 20 km/hr or less. The curb radii was reduced from 16 meters, to less than seven meters, slowing vehicle speed while still allowing for articulated buses and other large vehicles to turn. Tightened turning radii helped to reduce average turning speeds at LeGare from an average of 30 km/hr before, to an average of 18.5 km/hr after the intervention.

Observed average speed on right turn traffic before and after the LeGare transformation (Km/hr)

Weekdays (Before/After)



Weekends (Before/After)



User Perception

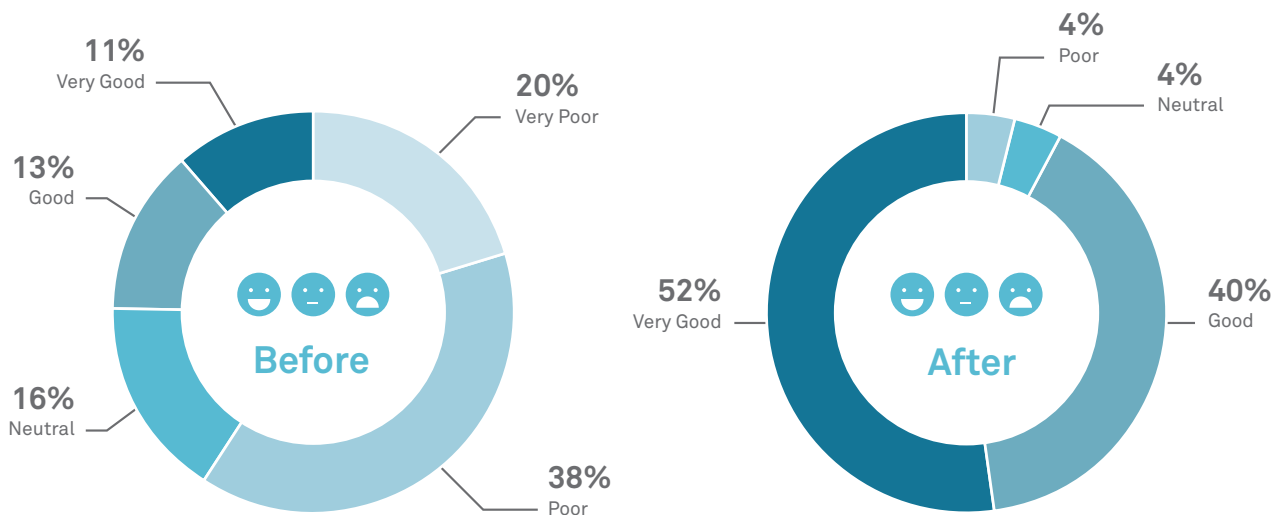
Surveys gathered information on user perception before and after the intersection transformation and found that 92 percent of respondents thought the transformed intersection was safer and more comfortable.

Other questions assessed public opinion regarding comfort, convenience, safety, security, and attractiveness of the intersection. Respondents were asked to rank their general feeling on pedestrian sidewalks and crosswalks, ranging from 'very poor' to 'very good'. The majority of respondents

surveyed before the transformation felt the intersection to be unsafe and poor, while most pedestrians felt safer and more comfortable after the transformation.

Sufficiency of the sidewalks was also assessed. Most respondents felt the pedestrian facility at or around the LaGare intersection was below average before the transformation. After the transformation, around 50 percent of respondents assessed the quality of infrastructure as 'very good'.

Road users' responses on the comfort, convenience, safety, and attractiveness of intersection before and after transformation



LESSONS LEARNED AND NEXT STEPS

The Safe Intersections Program (SIP) is a multi-disciplinary initiative that emerged from the Addis Ababa Road Safety Strategy. The program aims to transform ten intersections per year over the next three years, using strategies developed during the LeGare experience. In the process, the SIP will build interagency coordination and develop local capacity to implement safe street infrastructure across Addis Ababa.

The LeGare transformation, a first of its kind for Addis Ababa, showcased how relatively minor investment can dramatically improve streets.

Going forward, transformations will be pursued under the Safe Intersections Program—an initiative of the city’s Road Safety Strategy that will design and implement safe road infrastructure across Addis Ababa. The effort will fundamentally change the city’s streets, and help it to achieve its target to halve road deaths.

The LeGare experience will inform development of the Safe Intersections Program. Several lessons were learned along the way, including the following.

Engage key stakeholders early in the planning process.

The project was supported by TPMO, AACRA, and TMA from the beginning. Other agencies, such as the police and beautification agencies, joined the team later in the process. Given the critical role each of these organizations plays in successful implementation and enforcement, key stakeholders should be involved early in the planning process. The Safe Intersections Program aims to scale up intersection transformation efforts with assistance and engagement from key stakeholders from the very start.

Build enforcement capacity. While designers plan the streets, police officers must enforce the law. Without clear communication about the reason for and impacts of design changes, misperceptions may arise. (For example, officers at LeGare thought the updates were contributing to congestion.) The Safe Intersections Program will prioritize building police officer capacity on the importance of street design as well as the critical role that police play in improving safety.

Design to improve transit rider safety and experience. Many places in Addis Ababa currently lack dedicated transit stops, and riders can often be seen waiting and boarding from the roadbed. Through tightening the corner radii and aligning lanes at LeGare, underutilized space was reclaimed and repurposed for pedestrians, including space for passengers to wait for mini-bus taxis or purchase goods from vendors. Going forward, the Safe Intersections Program will aim to design to provide additional waiting and boarding spaces for transit users.

Use transformations as an opportunity to educate the public. Efforts to inform residents and others about the transformation in advance were inadequate. Strategic communications can help to build support for each intervention, and educate the broader public about the importance of improving road safety. The Safe Intersections Program will develop materials aimed at educating the general public before, during, and after transformations.

Collect and publicize data before and after interventions. Data should be used to measure and evaluate performance, and is critical for building support for future road safety interventions. Under the BIGRS initiative, the city of Addis Ababa has begun collecting and mapping crash data. The Safe Intersections Program will further support this effort to ensure impacts from physical transformations are adequately captured.

Develop and enforce maintenance and management programs. Due to lack of enforcement and poor maintenance of the planters and other street infrastructure, LeGare did not perform as well as it could have. Permanent infrastructure to be used in the next phase will help, but proper maintenance and management will still be required. Going forward, the Safe Intersections Program will clearly define agency roles and responsibilities to help maintain transformations over time.

As part of the Safe Intersections Program, the LeGare transformation will be made permanent, and intersections around Addis Ababa will be transformed.



Key Abbreviations

AACRA		Addis Ababa City Roads Authority
BIGRS		Bloomberg Philanthropies Initiative for Global Road Safety
EIABC		Ethiopian Institute for Architecture and Building Construction
GDCI		Global Designing Cities Initiative
iRAP		International Road Assessment Program
NACTO		National Association of City Transportation Officials
TMA		Traffic Management Agency
TPMO		Transport Programs Management Office
WB		World Bank
WRI		World Resources Institute

This report summarizes the LeGare intervention experience, and makes the case for permanently transforming this space through capital construction. Data presented throughout shows that the redesign has been effective in improving road safety in the LeGare area. It also demonstrates the power of interim interventions, which can be used to demonstrate effectiveness prior to capital investment. This interim report notes lessons learned, which should help to streamline future interventions across Addis Ababa.