

# CASE STUDY:

## CITY OF ROCKY MOUNT TIPPING FLOOR REPLACEMENT

### PROJECT DESCRIPTION

The City of Rocky Mount owns and operates a Solid Waste Transfer Station where solid waste is loaded for transfer to an approved solid waste landfill. Rather than garbage trucks making daily trips to a landfill, the trucks complete their route and deliver the garbage to a central transfer station, where they “tip-out” the garbage onto a concrete floor... the tipping floor. Over time the tipping floor deteriorates due to the constant pounding and scraping of heavy equipment. After just *four (4) years* of operation since the previous tipping floor replacement, the City noticed problems with the floor. The City was also experiencing failures in the steel push wall at the facility.

In 2014 the City contacted Appian Consulting Engineers to provide recommendations for repair of the tipping floor and push wall. Appian’s scope of work generally consisted of evaluating the existing floor and push wall, preparing a cost/benefit analysis of available options, providing recommendations for a long-term wearing floor surface, and preparing construction documents for the repair method selected.

### SITE INFORMATION:

LOCATION INFORMATION	
Facility Name:	City of Rocky Mount Transfer Station #2
Owner/Operator:	City of Rocky Mount
Address:	1221 Thorpe Road
City:	Rocky Mount
State:	NC
Tipping Floor Size:	5,550 sf (75' x 74')
Latitude/ Longitude:	35.970868, -77.795599

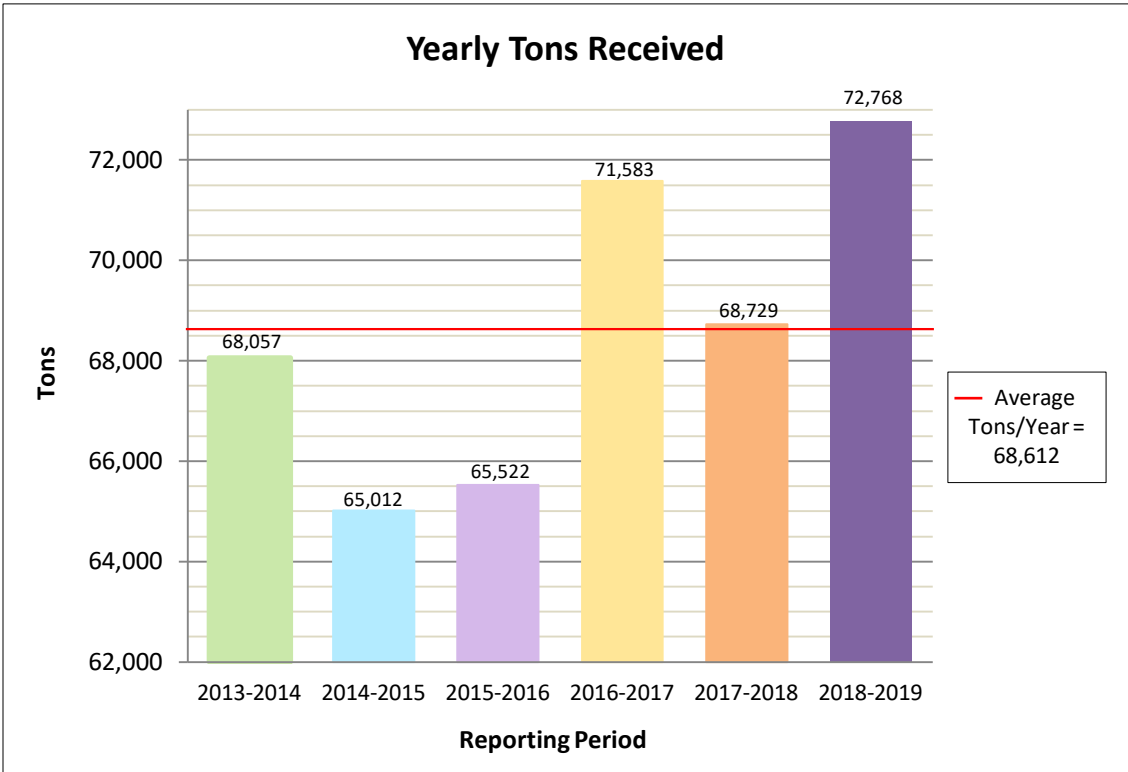
**SOLID WASTE VOLUMES & CHARACTERISTICS:**

The City of Rocky Mount receives municipal waste at this site in accordance with North Carolina Solid Waste Management Rules NCGS 130A. The facility does not accept hazardous waste, yard trash, liquid wastes, regulated medical waste, sharps not properly packaged, regulated-asbestos containing material and wastes banned from disposal. The waste collected at this transfer facility is transported off-site to a regional sanitary landfill facility. The City does not use chemicals for washing the concrete floor. The facility is regularly inspected by the North Carolina Department of Environmental Quality (NCDEQ) Division of Waste Management Solid Waste Section.

The facility operates 5 days/week for 52 weeks/year, with a total of 260 days/year in operation. From annual reports submitted to NCDEQ Solid Waste Section for reporting years 2013 to 2018, the following information was obtained:

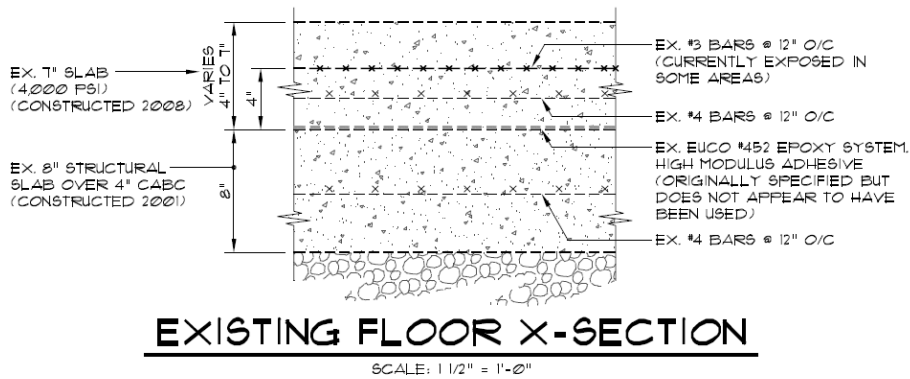
<b>SOLID WASTE RECEIVED<sup>1</sup>:</b>	
Tons/ year (avg)	68,612
Peak Tons/year in reporting period:	72,768
Tons/ quarter (avg):	17,082
Tons/ day (avg):	264

<sup>1</sup>Based on annual reports from July 2013 – June 2019



## EXISTING TIPPING FLOOR:

The original base concrete was installed in 2001, with an additional top concrete slab placed in 2008. The reinforced top slab was to be bonded to the existing substrate slab with epoxy adhesive. In spring of 2008, the bonded 7" slab was installed on top of the underlying 8" structural slab, at an approximate cost of \$88,000, or \$16/sf.



In 2012 the City began to notice that the floor showed significant signs of wear after just four (4) years of use. Large areas of the top slab had eroded 3" in depth, so that that reinforcing steel was exposed and in some places protruding dangerously. Almost 25% of the floor became severely eroded so the City installed an asphalt patch for temporary repair. The push wall also needed repairs, as the structural attachments had pushed through the wall leaving holes.

## THE NEW FLOOR

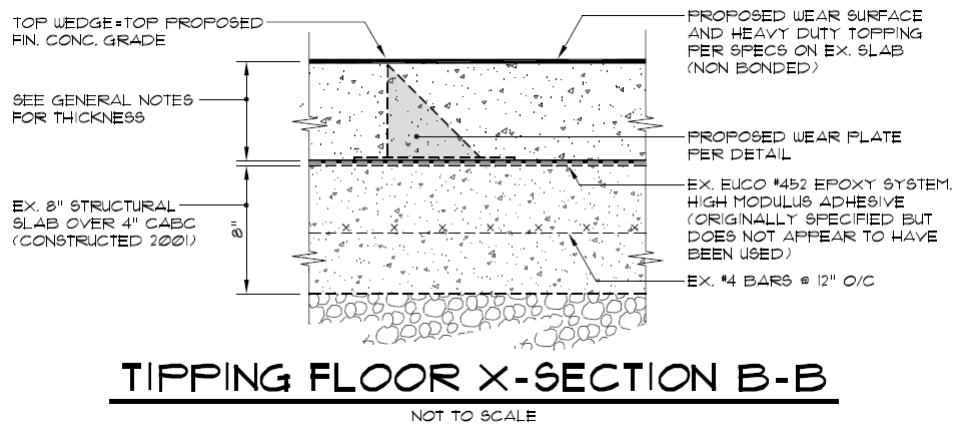
In 2014 the City contacted Appian Consulting Engineers to provide recommendations for repair of the tipping floor and push wall. The tipping floor replacement was to be part of an overall Transfer Station improvement project that included truck scale replacement, scale house exterior improvements, storm drainage and asphalt paving.

Appian consulted with Geotechnologies, Inc. to evaluate the condition of the existing floor and obtain concrete core samples for testing (see Geotechnologies report in Appendix). Chemical testing indicated that there did not appear to be a serious impact on concrete from acidic waste materials. There was no visual evidence that the concrete was being impacted by alkali-silica reaction (ASR).

As part of due diligence in researching repair options, Appian contacted numerous municipalities to determine their success with floor topping products and repair systems. We interviewed multiple tipping floor operators and researched several different overlays and toppings. Some of the products could be installed quickly, but frequently they did not meet expectations (at a cost of \$22 to \$45/sf). Several municipalities were extremely satisfied with work performed by Leak & Associates, who had installed tipping floors that successfully served for nine (9) to fifteen (15) years without signs of deterioration (at a cost of \$9/sf to \$33/sf).

Appian prepared a bid package and plans to remove and replace the existing 7 inch solid waste tipping floor and install a 6-inch wear course. The bid package was structured to enable bidders to provide an alternate design/build method or proprietary concrete slab that would provide adequate wear resistance with 10 to 15 years longevity.

The typical section below shows the proposed floor section for bidding, though it was revised during construction.



## COST

The City received bids and awarded a design/build contract to Leak & Associates for the placement of the concrete top slab and repairs to the push walls.

PROJECT COST:	
Placement of Concrete Top Slab (5,550 sf):	\$ 137,000
Replacement of Steel Push Wall:	\$ 55,000
<b>Total Contract Amount:</b>	<b>\$ 192,000</b>
Cost/sf (of Tipping Floor Wear Course Only):	\$ 25/sf

The contractor provided engineering design and sealed construction plans prepared by Simpson Gumpertz & Heger, Inc., that included the following:

- Design for constructing a “sacrificial” concrete slab on top of the existing slab. The concrete for the new topping slab was optimized to have low shrinkage and curl and high abrasion resistance by the incorporation of a shrinkage reducing admixture (SRA) and optimizing cementitious materials and aggregate gradation. Additionally, the slab was reinforced, jointed and details to minimize cracking and wear.
- Plans for removal of damaged floor areas prior to placement of the topping slab.
- Design of approximately one-hundred fifty (150) feet of new steel-plated reinforced concrete push wall (4 to 8 feet in height, 8 inch thick).
- The floor was engineered in such a manner that when isolated areas would require repair or replacement, just those areas need be removed and not the entire floor. This feature was instrumental in the City’s decision to install the “sacrificial floor” concept.

## CONSTRUCTION

To accommodate for repairs to the push wall, installation of the new concrete floor and installation of a new asphalt apron, the entire project consisted of a ten (10) day continuous period of construction beginning on a Thursday after normal closing hours (4:00 pm), continuing the next week and ending Monday morning prior to normal operating hours (7:00 am). The construction period was June 19 to 27, 2014. The tipping floor was closed for eight (8) working days, during which an old tipping floor adjacent to the facility was used. Trash delivery was not interrupted.

Construction generally consisted of:

- Construction of a new metal plated reinforced concrete wall
- Removal of areas of existing floor damage
- Setting reinforcing rebar for new tipping floor
- Constructing a new 5,550 sf sacrificial concrete floor (6" to 9" in depth)
- Placement of four (4) wear plate indicators, where the top of the triangular wear plate was set at the top of the finished concrete grade
- Milling of existing asphalt exterior apron to ensure smooth transition from the new tipping floor elevation to the existing apron elevation
- Placement of asphalt apron in front of tipping floor
- As-built survey

## TESTING

Geotechnologies provided concrete testing services throughout construction (see concrete strength test results in Appendix).

<b>CONCRETE STRENGTH TEST RESULTS – DAY 3</b>	
Location	Strength (psi)
1A	4,430
2A	4,640
3A	4,110
4A	4,400
<b>Average at 3 days = 4,395 psi</b>	

<b>CONCRETE STRENGTH TEST RESULTS – DAY 28</b>	
Location	Strength (psi)
1B	6,720
1C	6,580
1D	6,880
1E	6,900
2B	6,900
2C	7,050
2D	6,860
2E	7,250
3B	6,370
3C	6,420
3D	6,110
3E	6,330
4B	6,670
4C	7,000
4D	6,470
4E	6,940
<b>Average at 28 days = 6,716 psi</b>	

The project was completed on time with no change orders. More than 200 cy of concrete were installed and provided 80% strength after just three (3) days, allowing transfer station operations to resume as scheduled.

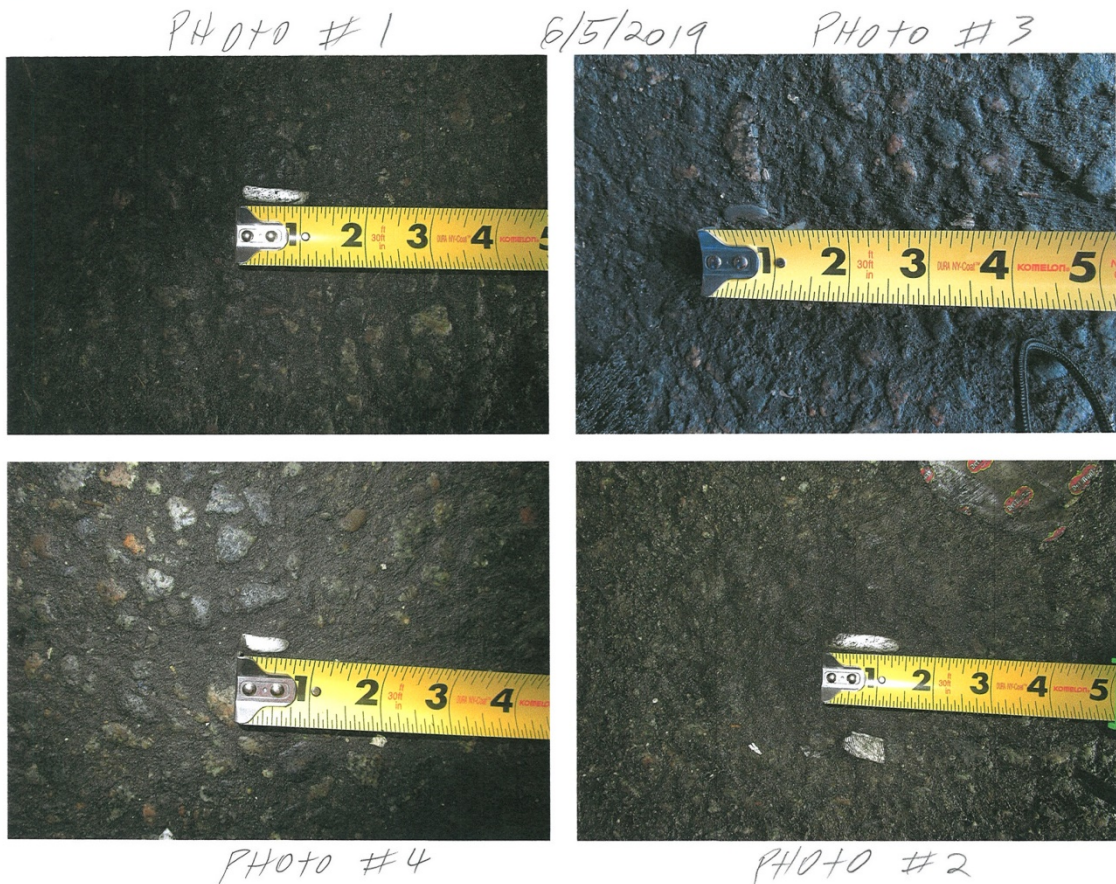
FIVE YEARS LATER

Appian inspected the tipping floor facility in June 2019 to evaluate its performance and found the push wall and tipping floor in excellent condition. We interviewed City staff who said that were very pleased with how the facility was performing, noting that the floor was holding up much better than previous overlay repairs. There was no gouging or areas of concern, even after the City had processed almost 350,000 tons of solid waste since installation of the floor in 2014.

Appian obtained detailed measurements of the wear plates and determined that there was minimal deterioration of the sacrificial wear slab over the past five (5) years.

TIPPING FLOOR WEAR PLATE MEASUREMENTS (6/5/19):	
Wear Plate #1	1-1/8"
Wear Plate #2	1-3/8"
Wear Plate #3	3/4"
Wear Plate #4	5/8"

The wear plates indicate that the average deterioration of the new sacrificial floor (6" to 9" concrete slab) was less than 1 inch in the past five (5) years. At the current rate, the projected life expectancy is more than 20 years without the need to replace the floor. If repairs are needed in the future, the floor is designed in such a manner that only the required sections need be replaced, not the entire floor... saving significant expense.





## CONCLUSION

The City of Rocky Mount Transfer Station Tipping Floor is performing better than expected, with no concerns or significant deterioration in the first five (5) years. The City's decision to award the project as a design/build construction project while maintaining third party engineering supervision proved to be a great success.

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