Robot Used to Tie Rebar: Automated Technology Comes to I-93 Construction!

NH Route 102 Bridge deck showing rebar layout

The new NH Route 102 Bridge over I-93 that connects Londonderry and Derry at Exit 4 is nearing completion as part of the 14633D project. This new structure is one of the largest bridges being built as part of the I-93 expansion, measuring over 300 feet long and carrying seven lanes of traffic. As with all structures built of concrete, the concrete is strengthened with reinforcing steel bar, commonly referred to as "rebar". The rebar is typically placed in a grid pattern as shown in the accompanying photos. The rebar is put in place prior to the pouring of the concrete, and to make sure the rebar does not move it is tied together at each intersection of the grid pattern. On a bridge like NH Route 102, there are literally thousands of these intersections.

Historically, tying rebar has been a very labor intensive task that required several people to work all day for many days bent over at the waist tying each intersection of rebar by hand. This back breaking work is very repetitive and not the best use of experienced construction workers. Audley Inc., the contractor building the NH Route 102 Bridge, decided to bring in a solution that gets the job done, while freeing up its labor force to focus their skills on more challenging tasks. The "TyBot", an automated robot, was used to tie the rebar. Suspended over the bridge deck, this robot has sensors that detect an intersection of the rebar, makes a tie and then moves on. The TyBot took the same amount of time to complete the task as the typical crew would have taken, but the TyBot does not get a sore back or stop for rain — it just keeps going. The operation of the robot is overseen by one person, freeing up a half dozen or more to work on other aspects of the project. This is the first time that TyBot has been used in New England, but based on the success of this project, most likely it will not be the last.

TyBot robot suspended above bridge deck

TyBot robot at work, overseen by one worker

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REBUILDING I-93 salem to manchester

I-93 IMPROVEMENTS

2018: I-93 Widening Construction Ramps Up

Significant progress has been made since construction of the I-93 Improvements started in 2006. Most of the improvements from Exit 3 to the south have already been built and drivers are enjoying the corridor's enhanced efficiency.

Relatively few projects remain to be constructed. Work on the four projects that are currently under construction is ramping up this summer and fall because the targeted completion date for these projects is 2020, which is approaching rapidly. This construction season will involve a big push to get through the bulk of the major construction so that in 2019 and 2020 the construction undertakings will taper and these projects will draw towards completion. Summer 2018 milestones will include:

- NH Route 102 Bridge at Exit 4 (a part of Contract 14633D) will be open at the end of July 2018, and NH Route 102 work will be substantially complete this season.
- The new section of I-93 southbound mainline between Kendall Pond Road and the Weigh Station (Contract 14633B) will be open late this summer.

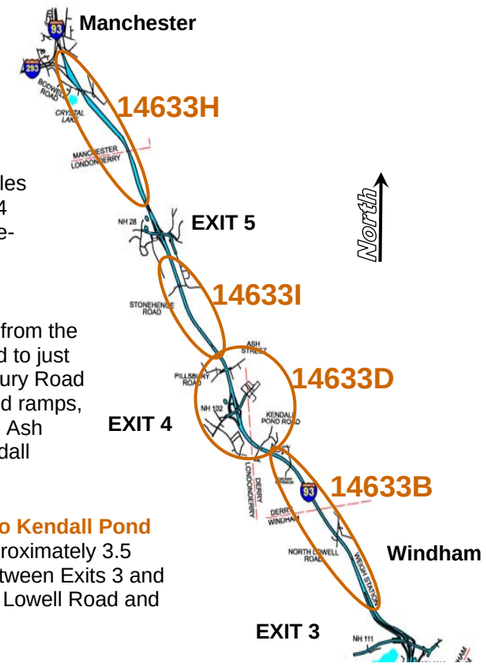
Current I-93 Construction Projects

Contract 14633H - North of Exit 5 to the I-293 Interchange
Reconstructs NB and SB I-93 roadways to four lanes north of Exit 5.

Contract 14633I - Exit 4 to Exit 5
Reconstructs and widens about 2 miles of NB and SB mainline north of Exit 4 including widening work on the Stonehenge Road Bridge.

Contract 14633D - Exit 4 Area
Reconstructs and widens northward from the I-93 Bridges over Kendall Pond Road to just north of the historic Ash Street/Pillsbury Road Bridge, reconstructing the northbound ramps, replacing the NH 102 Bridge and the Ash Street Bridge, and widening the Kendall Pond Road Bridges.

Contract 14633B - Weigh Station to Kendall Pond Road Reconstructs and widens approximately 3.5 miles of NB and SB I-93 mainline between Exits 3 and 4. Work includes widening the North Lowell Road and Fordway Extension Bridges.



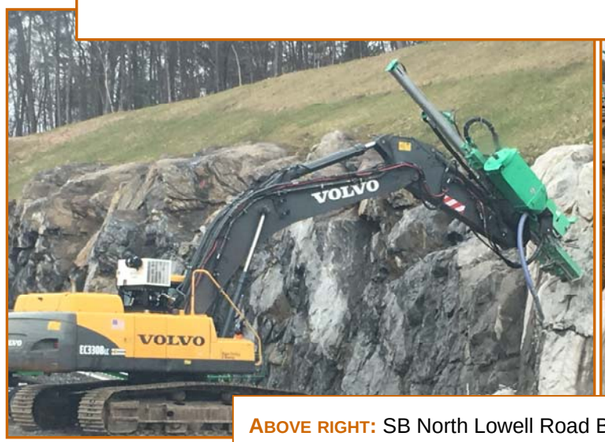
CONSTRUCTION COMPLETE

Exit 3 Park and Ride

Contract 10418H is complete. It constructed a new Park and Ride facility in the area of Exit 3, just east of the I-93 northbound off-ramp in Windham, thereby creating over 140 spaces for vehicles. The new Park and Ride facility opened on November 6, 2017 and it can be accessed from the newly constructed portion of NH Route 111A.

NB and SB Mainline Widening, Weigh Station to Kendall Pond Road

Contract 14633B is about 70% complete and has been under construction since spring of 2016. It is anticipated to be complete in the fall of 2019. Recently, hand scaling of the southern ledge cut took place, to remove any small loose rock that may remain at the top or along the face. Work on the North Lowell Road Bridge continues. SB roadway work outside of traffic will also continue with base course materials and pavement placement. ITS conduit will be installed along with camera foundations.



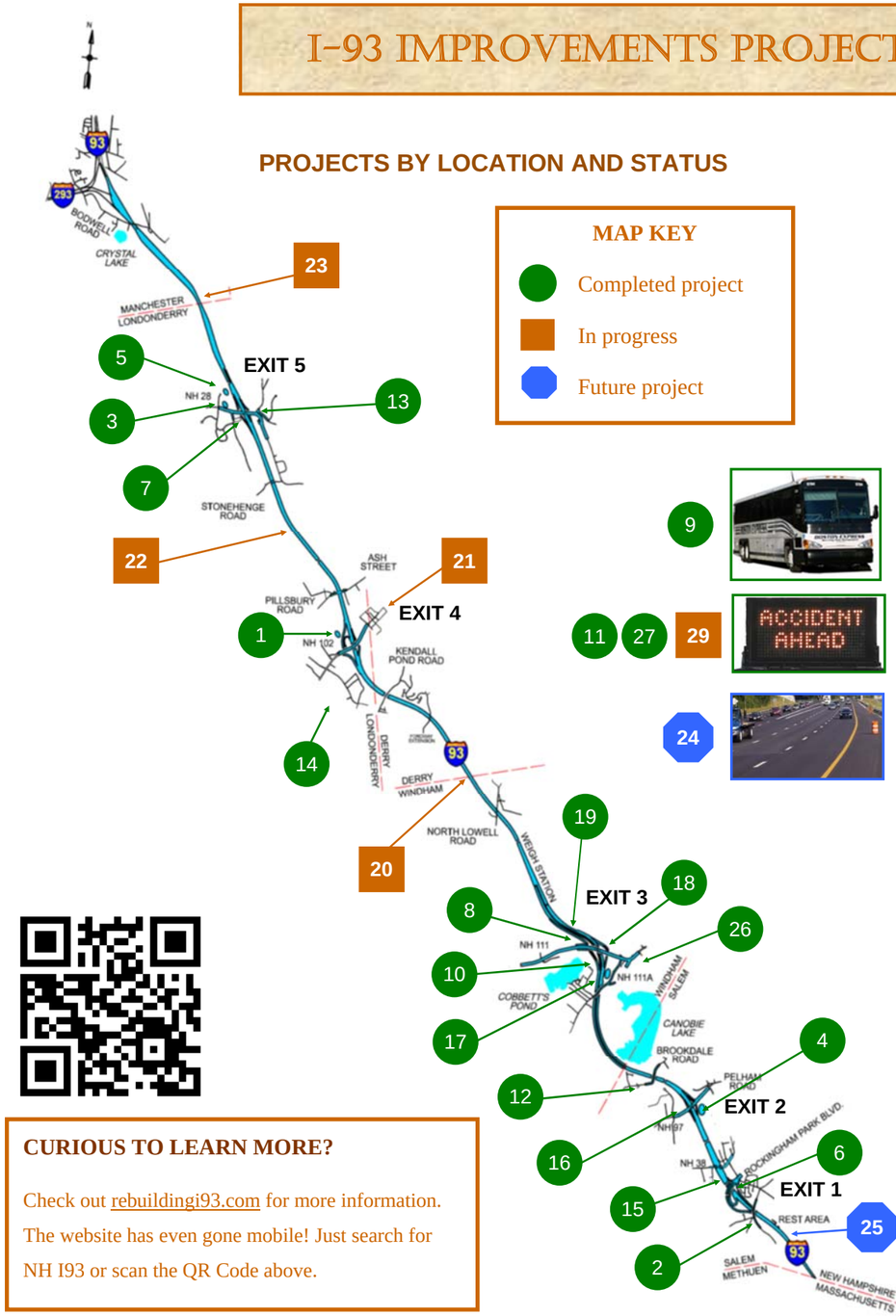
ABOVE RIGHT: SB North Lowell Road Bridge back-filling.
ABOVE LEFT: Installation of rock bolts and dowels in southern ledge cut.

I-93 PROJECT SUMMARY OF CONSTRUCTION PROJECTS TO DATE

	Status	Project Description	Contract Number	Constructed To/From	Cost (M)
1	Complete	Exit 4 Bus Terminal/Park and Ride	10418M	01/06 - 05/07	$1.4
2	Complete	Cross Street Bridge	13933B	11/06 - 10/08	$6.6
3	Complete	Exit 5 PNR/Rockingham Road	10418I	12/06 - 10/08	$4.8
4	Complete	Exit 2 Bus Terminal/Park and Ride	10418G	03/07 - 10/08	$7.1
5	Complete	Exit 5 Bus Terminal/Maintenance Facility	10418N	08/07 - 10/08	$7.4
6	Complete	Exit 1 Ramps & Bridges	13933C	09/07 - 10/09	$24.1
7	Complete	Exit 5 Ramps & Bridges	14633E	07/08 - 05/10	$15.1
8	Complete	Exit 3 SB Off-Ramp & NB Bridges	13933K	09/08 - 11/10	$26.7
9	Complete	Bus Procurement - Operation for Expanded Service	10418L	Service Began 11/08	$19.1
10	Complete	Exit 3 NB Mainline	13933G	06/09 - 04/12	$30.8
11	Complete	Phase I Intelligent Transportation Systems (ITS)	10418Z	11/09 - 11/11	$4.5
12	Complete	Brookdale Road Bridge	13933F	08/10 - 07/12	$5.0
13	Complete	Exit 5/Route 28 Interchange	14633F	03/11 - 10/14	$35.8
14	Complete	South Road Mitigation	10418F	03/11 - 08/14	$1.1
15	Complete	Exit 1 Area, NB & SB Mainline	13933D	03/11 - 08/13	$31.0
16	Complete	Exit 2 Interchange Reconstruction	13933E	08/12—03/16	$43.6
17	Complete	Exit 3 SB Bridges over Routes 111 & 111A	13933N	01/12 - 09/13	$11.4
18	Complete	Exit 3 SB Mainline, SB On-Ramp & NH 111	13933I	10/12 - 10/16	$33.9
19	Complete	Exit 3 NB Mainline, NH Route 111A	13933H	12/13 - 05/17	$32.9
26	Complete	Exit 3 Park and Ride	10418H	11/16 - 11/17	$1.8
27	Complete	Smart Work Zone	13933Z	7/11 - 5/15	$1.4
28	Complete	Misc. Early Construction Projects	Misc.	Prior to 2007	$0.6
				Completed Construction subtotal:	**$346.1**
20	In Progress	NB & SB Mainline between Exit 3 & 4	14633B	02/16 - 10/19	$54.4
21	In Progress	NB & SB Mainline, Ramps & NH 102 Br. at Exit 4	14633D	01/17 - 09/20	$66.7
22	In Progress	NB & SB Mainline between Exit 4 & 5	14633I	03/17 - 08/19	$36.5
23	In Progress	NB & SB Mainline North of Exit 5	14633H	06/16 - 10/19	$48.8
29	In Progress	Smart Work Zone	14633Z	04/15 - 09/18	$1.7
				Under Construction subtotal:	**$208.1**
24	Future	Future Corridor Paving	14633J	2018-2020	$10.5
25	Future	NB & SB Mainline South of Exit 1	13933A	2019-2020	$20.7
				Future Projects subtotal:	**$35.4**
				Total Construction Cost:	**$589.6**

I-93 IMPROVEMENTS PROJECTS

PROJECTS BY LOCATION AND STATUS



CURIOUS TO LEARN MORE?

Check out rebuildingi93.com for more information. The website has even gone mobile! Just search for NH I93 or scan the QR Code above.

Exit 4 Ramps, with NB and SB Mainline Widening

Contract 14633D is 40% complete and has been under construction since spring of 2017. It is anticipated to be complete in the fall of 2019. Recently, construction included installation of structural steel and the setting of deck panels for the new Ash Street/Pillsbury Road Bridge, and the NB mainline approaching NH Route 102 Bridge and the NB off-ramp were paved. It's anticipated the NH Route 102 Bridge will open to traffic in August of 2018. Construction of the MSE wall along I-93 NB was completed. And work on the NB Beaver Brook Bridge will resume soon.

BELOW LEFT: Setting of the Ash Street/Pillsbury Road Bridge deck panels.
RIGHT: Drainage installation undergoes construction.

LEFT: Ash Street/Pillsbury Road Bridge structural steel is set.
ABOVE: A TyBot ties reinforcing steel on NH Route 102 Bridge. (See page 8 for more information.)

NB & SB Mainline Widening, Between Exit 4 and Exit 5

Contract 14633I is nearly half complete and has been under construction since spring of 2017. It is anticipated to be complete in the fall of 2019. The soundwall berm has been nearly built to grade; work continues for the bridge carrying SB over Stonehenge Road including setting of new concrete beams for the widened portion of the bridge; and all pavement markings were re-striped.

LEFT: I-93 SB soundwall berm hydroseeding, facing north.
ABOVE: Workers tying rebar intersections on SB Bridge over Stonehenge Road approach slab, facing north.

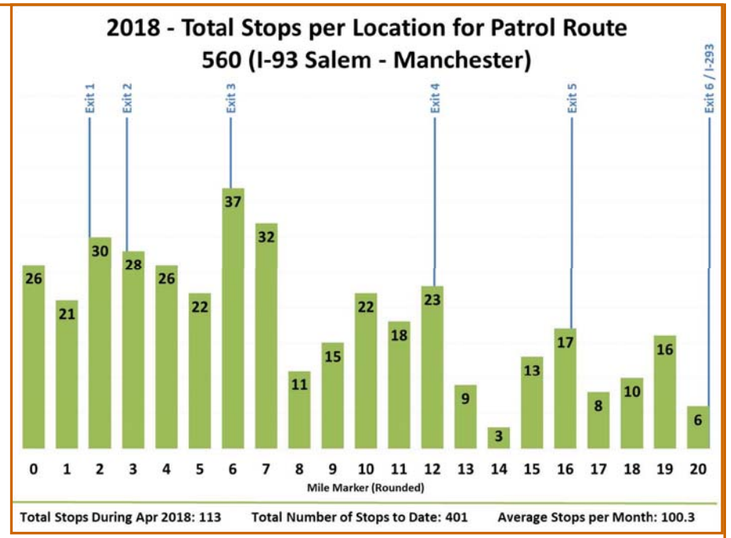
North of Exit 5 to the I-293 Interchange

Contract 14633H is over half complete and has been under construction since spring 2016. It is anticipated to be complete in the fall of 2019. Pavement is being removed from the old roadway starting at the south end. Construction continues on the NB bridges over Cohas Brook and Bodwell Road, and will include reinforcing and pouring the backwalls and wingwalls; select materials have been placed in the SB I-93 roadway preparing the area for paving; and traffic shifts can be expected to accommodate further work.

LEFT: The last of the MSE wall panels were installed at the northern box culvert.
RIGHT: Paving.

Service Patrol

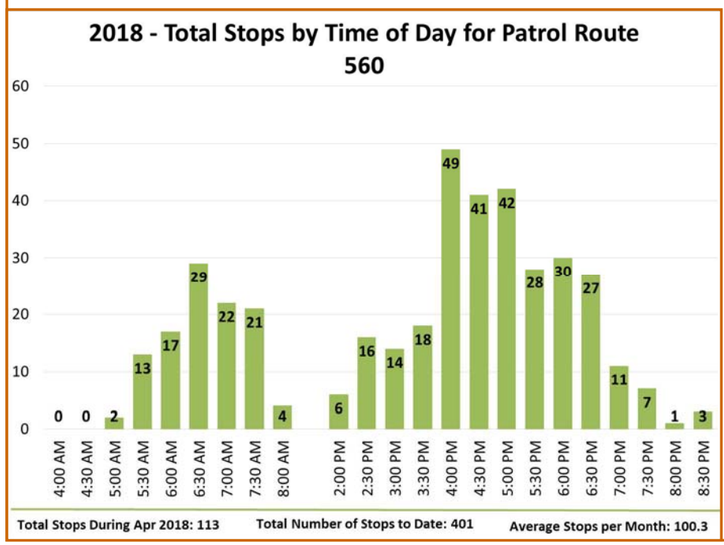
Aside from construction projects, there are other projects within the I-93 corridor that are equally important that assist with Incident Management behind the scenes by addressing the mobility and safety implications of traffic incidents on the I-93 corridor from the Massachusetts border in Salem to I-293 split in Manchester. An example of this type of project is the 10418T project which implements the Service Patrol vehicle along the I-93 corridor (NHDOT Patrol 560).



Most incidents on major highways are relatively minor in nature, e.g., flat tires, running out of fuel, overheating, or even simple debris in the roadway. However, it has been shown that even such minor incidents on the shoulder of a busy highway can have a significant impact on lane capacity, vehicle speeds, and driver safety. This impact is due to the shying away from fixed or still objects near the travel way. The impact of minor incidents can increase during construction when minimum shoulders or other restrictions exist. During peak traffic volume flows, these minor incidents could cause major congestion and possibly contribute to more serious secondary incidents.

In an effort to address these minor incidents, the service patrol concept was implemented by the NHDOT with funding supplied through the Federal Highway Administration (FHWA) and private sector funds (sponsors). This started as a trial operation in 2009 with a pickup truck to provide minimal services to prove the concept of the strategy.

The trial was a success. The results were verified through coordination and communication with local police and fire departments as well as with the State Police. Moreover, there were other benefits that became more apparent after the trial. For example, the implementation of the service patrol vehicle along the I-93 corridor enabled it to:



- provide on-scene safety for larger incidents as directed by State Police (providing cones, flares, etc.)
- assist in traffic control operations during the initial stages of major incidents to reduce the possibility of secondary incidents
- foster inter-agency cooperation and communication by virtue of being on scene during an incident facilitating face-to-face communication.

The Service Patrol was expanded to offer more services and continues on the I-93 project assisting motorists. From January to April 2018, there were 401 stops made to assist motorists. This concept has also been extended to other locations such as Interstate 95 and has continued to be a success.