SMART WALLS
TRIPLE DECKER

Smart Walls Construction LLC
1576 Sweet Home Rd. Suite 216
Amherst, NY 14228
(716) 954-9734
info@smartwallsconstruction.com

1. Introduction (1 page)

The **Smart Walls** are structural walls developed by Smart Walls Construction, LLC. The proprietary technology consists on Ultra-High-Performance-Concrete structural wall that connect with each other in a telescopic or stackable fashion. We have been awarded more than $1M for the development of this innovative structural system towards its use as a flood and storm-surge protection wall (https://youtu.be/29rgFpJYaHo). Most recently, we were among the winners of the RISE Coastal Resilience Challenge to pilot the Smart Walls technology in the City of Norfolk, VA, in a way that can scale and replicate to other coastal cities that are being impacted by sea-level rise.

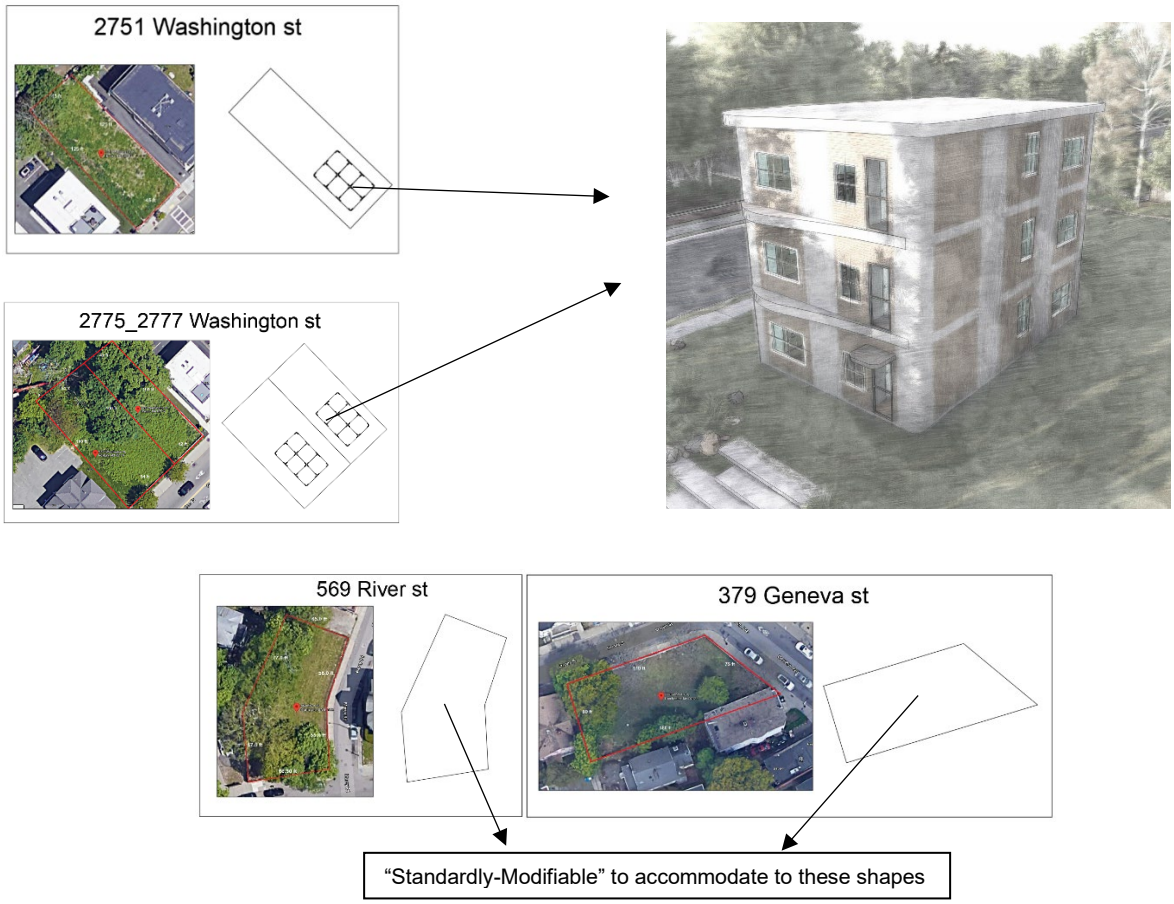
Sea-level rise is not the only problem cities are experiencing – affordable housing is the other one, and that is what brought us here. We believe that cities of tomorrow must take shape by adopting gradually the innovations that come from new manufacturing processes, new construction methods and new materials. As a result, cities' built environment will be able to accommodate population growth in such a way that equitable housing development models are achieved.

We believe that the Smart Walls is a good starting point to achieve that equitable housing model. We will do it by embracing innovation from an early stage, and by adopting a performance- and manufacture-based design approach (please see more details in proposal's narrative). The system was invented by Jorge Cueto, who is the founder and CEO of Smart Walls Construction, LLC. Jorge is originally from Colombia and came to the U.S. thanks to a Fulbright scholarship to pursue his Doctoral Degree. He holds a Ph.D. in Civil Engineering from the University at Buffalo in NY, and has over 10 years of experience in the structural design of buildings and bridges as an independent consultant and contractor. Bringing this innovative structural system and construction method to reality has made Jorge the recipient of multiple patents and several awards such as the Outstanding Young Alumnus Award and the Best Entrepreneur Award from the American Society of Civil Engineers (www.linkedin.com/in/jorge-cueto-5441321b8). Also, great partnerships have been forged with companies and like-minded people from the manufacturing, academia and material science/providers. Some of the initial collaborators that are expected to play a role in this are Carlos Vera, from Linita Design and Manufacturing, Inc; Rich Burguess, from CorTuf UHPC, Inc. We have the core team ready for the design and manufacture of the key components of the Smart Walls when used in buildings such as the triple decker here proposed. However, we understand that we can't nor we want to do this alone. We see this process with the Housing Innovation Lab and the BSA not only as a way to propose a new idea, but to meet like-minded people and entities from Boston that we will seek to create partnerships with to co-create the next generation of triple decker buildings that can be scalable and replicable to different locations around the city, and beyond.

2. Site Selection (1 page)

We see this with the eyes that the structural system and construction method using Smart Walls can be replicated in multiple sites. The idea lies in the standardization of key components of the design (both, architecture and engineering). We are interested in exploring with the city the replicability and scalability of the system as the most beneficial feature to achieve affordability in this housing model. However, adaptability and shape-ability without compromising affordability are also key factors that we can achieved with our structural system, and that will bring the value of not being the same standard building all around the city. Instead, key factors that affect adversely the affordability will remain standard (or "standardly-modifiable"– we can elaborate more in this weird new term that, we promise, it is promisable!) so other factors such as outer façades can change to adapt to the specific surroundings of the area. In contrast, the opposite way to see this idea is to explore a unique design with such character in its shape and material selection, that it can become an icon for the city to explore its replicability all throughout.

Having said all that above, and with the intention of focusing in one location for a pilot project, we believe that 2751 (as well as 2775&1777) Washington St are ideal locations for the "standard" version of the Smart Walls Triple Decker we are proposing. Other sites that can be used to test the "standardly-modifiable" concept is on 569 River St and 379 Geneva St.



3. Proposal (7 pages)

3.1 Project Narrative

The Smart Walls Triple Decker will be built using new materials and a new construction method, where Ultra-High-Performance Concrete (UHPC) can be shaped in hollow sections that can later be connected in a telescopic or stackable fashion. **The core of the value proposition lies on the use of a combination between new materials, a new construction method and the use of digital engineering**… Please! don't get us wrong, we are not trying to re-invent the wheel and invent everything at once. Instead, we are using concepts and methods that have been in use for a while in other industries, and applying them in the design and construction of buildings. This is the case of the material, the UHPC, that has been long used for overlays in bridges. However, it is starting to be used in other things different than infrastructure. The new construction method is aiming at bringing the best of the modular construction of buildings that is becoming a proven system if a high level of affordability wants to be achieved, with the tweak of utilizing a new way of interconnecting structural elements (please excuse us that we don't explain in more detail this specific "new way" part, but it is part of the IP we would like to share with all stakeholders of the project at a later time, should we move forward in the process). Lastly, the use of digital engineering concepts will make the design of the triple decker be conceived with a performance- and manufacture-based approach. Briefly, in the performance and manufacture-based design approach, Key Performance Indicators (KPIs) are set to be achieved by the use of standard structural and non-structural sections for which the end-result (in terms of geometry, strength and manufacturability, among others) is known. The KPIs are based on functionality, cost, constructability, geometry, among others. This is where stakeholders of the project get together and try to define what are those goals that the building must meet, and establish certain red lines that cannot be crossed, then, thanks to the digital engineering approach, iterative processes can happen rapidly to yield a solution within the limits set by those KPIs. The result of that is a design of a new type of Triple Decker that can be partially or completely manufactured off-site and bring to the site for final assembly.

We strongly believe this approach will yield a scalable and replicable solution of the triple decker that can be easily adaptable to different sites almost-regardless of the shape and size of the lot, this is because:

1) We use new materials that:
    a. Are more friendly to be shapeable and manufactured off-site.
    b. Are durable and highly optimizable in strength and weight.
    c. Have the ability to create structural shapes that provide a unique configuration that brings a balance between elegant design and structural efficiency.
    d. Are an alternative to conventional materials which price is skyrocketing

2) We use a new construction method that: (See more details and sketches in Section 3.2)
    a. Allows a complete or partial manufacture of the building elements off-site and then assemble them at the final site.
    b. Is unique to precast concrete structural pieces, but it permits the rapid and secure connection with other non-concrete structural and non-structural pieces.

c. Reduce the time to manufacture and assembly of the building components.

3) We use a design approach that:
   a. Focuses on the desired outcome first. In doing so, budget goals can be established from the very beginning and work the way up to yield the best structural solution.
   b. It makes the triple decker be scalable and replicable to other sites.

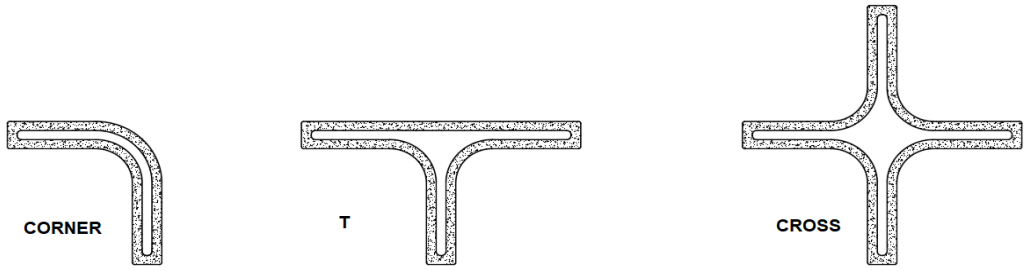
We strongly believe that the combination of 1), 2) and 3), will make the Smart Walls Triple Decker meet the city goals because:

- It will use innovative design approaches that can be adapted to the diverse needs of the people of the city.
- It will be affordable since the design will allow for optimization of the material and time in manufacture and assembly.
- Its digital engineering approach will allow for an easy replicability and scalability of the system. This in turns allows for a faster design and manufacture methods that can be adopted by different contractors and designers all throughout the city, so the goal of adding 69,000 new units by 2030 is achieved.
- The ability to assemble the Smart Walls in a telescopic or stackable fashion will allow for a future addition of a new floor connected at the top. This means that the building may be thought to be extendable upwards, as such, it will accommodate growth of housing units vertically, not horizontally where space is limited.

3.2 Project Concept

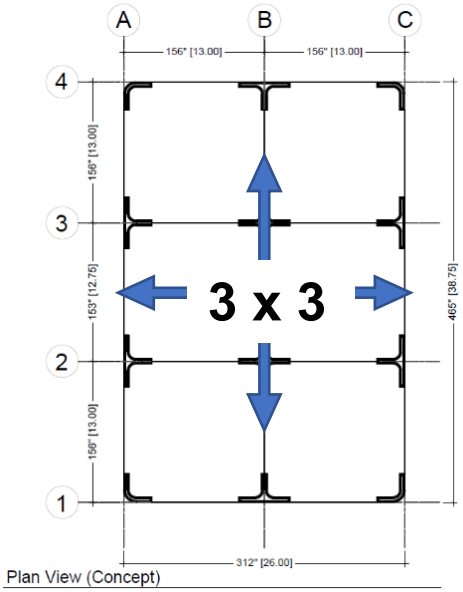
The project lies on the concept of the number 3: Three structural shapes, three by three plan distribution, and three stories (extendable to a fourth one).

Three Structural Shapes:
These structural shapes are designed to be structurally efficient while providing the building with an elegant and futuristic design that can only be given by curves.



The strength, interconnection and manufacturability of these shapes is possible thanks to proprietary technology that we have developed, as well as thanks to the shape-ability of the UHPC we use.
The sections can be completely or partially hollowed to achieve strength and weight optimization and efficiency. The hollow areas may be thought to accommodate ducts inside.

Three by three layout:

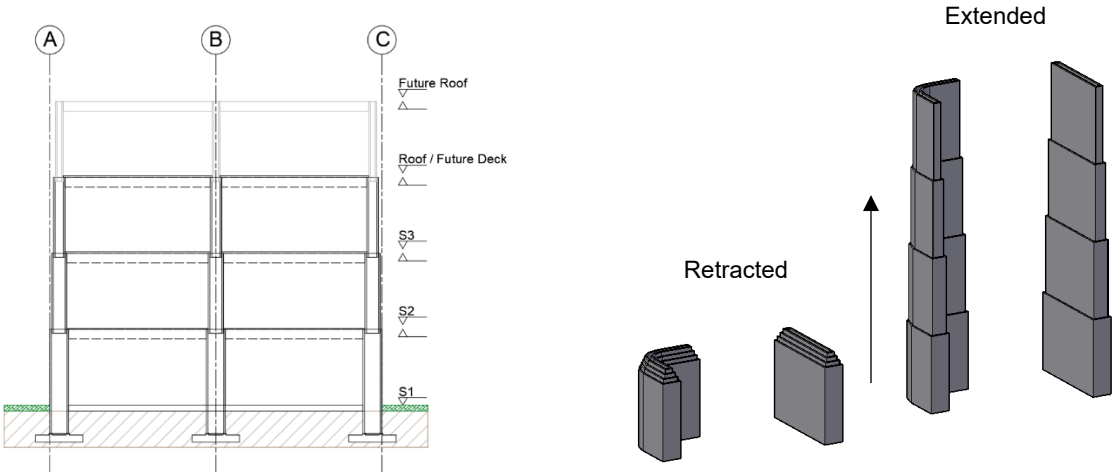


Plan View (Concept)
Scale N/A

(See attachment 1)

Three stories:

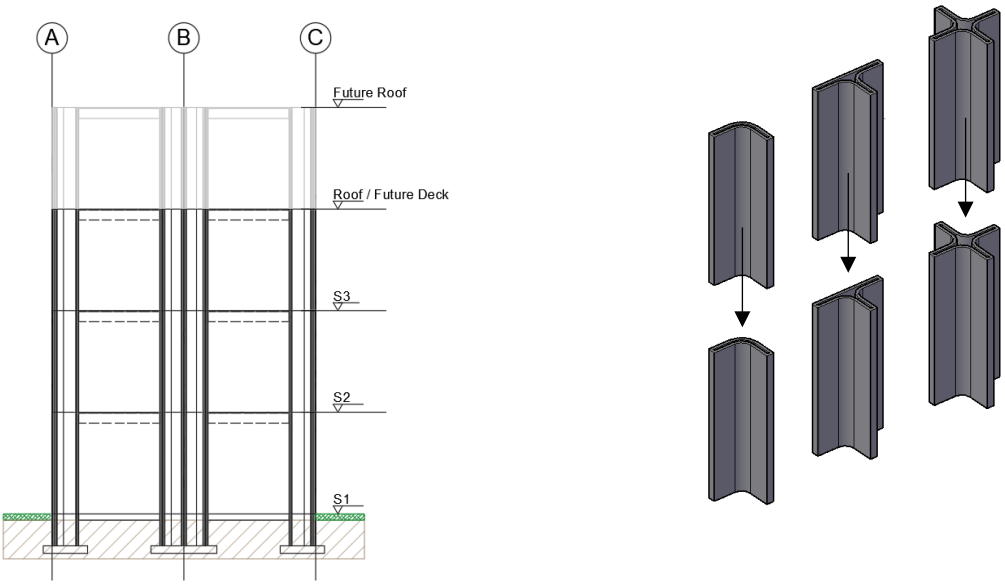
The Smart Walls, engineered and manufactured in all three different shapes mentioned before, can be telescopic, in which case, the walls will get to the site in the retracted position, and later extended. This approach is aimed at the rapid erection of the vertical elements. However, we do understand that it may bring reductions in space within the building. Consequently, the other alternative to explore is to stack the walls up. Also, the alternative mentioned may be to either stack only the walls up, or to manufacture the entire story off-site and transport the individual stories and stack them up on-site.



Concept of telescopic Smart Walls

Some of the Smart Walls units already built when used for flood protection (see picture below) can give an idea of the manufacturability of UHPC curved shapes that enhance the structural response of the building, while allowing for innovative construction/assembly methods to be implemented.

Reduced-Scale Prototypes of UHPC Telescopic Smart Walls for Buildings (left, retracted; right, extended)



Concept of Stackable Smart Walls

PROPOSED END RESULT


SPEED
LIMIT
40


TRIPLE DECKER
SMART WALLS
SMART
WALLS

3.3 Project Barriers

We have been developing the technology towards its use for flood and storm-surge protection of cities. Several tests have been conducted to demonstrate the strength and functionality of the core components of the Smart Walls. Furthermore, we have developed techniques for the rapid geometric design and manufacturability that are scalable to any size Smart Wall. For the case of the Smart Walls used in buildings, tests to subject the walls to higher vertical loads should be carried out. These tests will not be to know whether the walls are strong enough – they are! and they can be designed to be as strong as needed. The testing is more about finding the right thickness and material mix that can yield a balance between the strength, cost and weight.

Another key barrier is that we understand that implementing a new idea in a “real public setup” may create some pushback. To that purpose, and taking advantage of the construction method, the building, or a representative portion of it, can be erected in-house, this is, inside our facilities (or a partner facility that is near Boston), to demonstrate the process and the strength, and then it can be dismantled to be taken to it final position in one of the sites selected for a pilot project.

Lastly and although it is not a barrier per se, we don’t want to create the impression that this is 100% engineering-oriented design, we want to create key partnerships with architects and contractors from the area, as well as people from the city, which input will become instrumental in determining key factors on the design of the Smart Walls.

3.4 Final Remarks

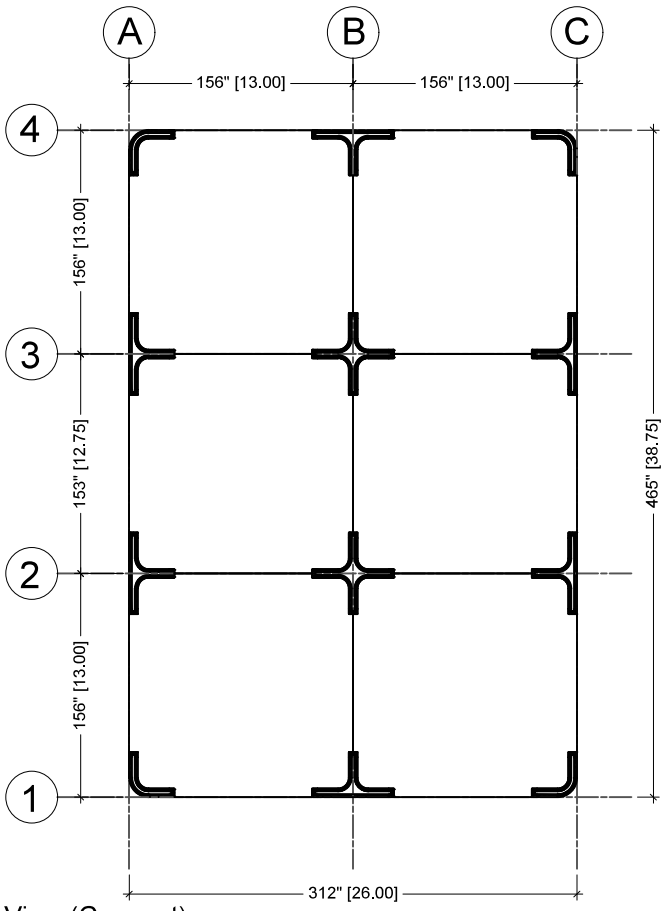
The images presented here are aimed at giving a first glance of how we envision the future triple decker should be when using Smart Walls. The final distribution of space, the dimensions of the vertical elements and the shapes of the Smart Walls we are proposing, are expected to undergo a more detailed design where we can capture the input of the key partners we expect to have, so we can all together combine innovation, advanced manufacturing, advanced materials, and professional experience, to co-create Boston’s future triple decker with Smart Walls.

3.5 Permission

I give permission for the ideas to be shared with a wider public audience. In fact, I know that not everything is explained in this document, and we have much more information to share with interested parties. In this way, we can send the message that this system, despite being new, it is ready for showtime and to start changing the built-environment of the cities for good.

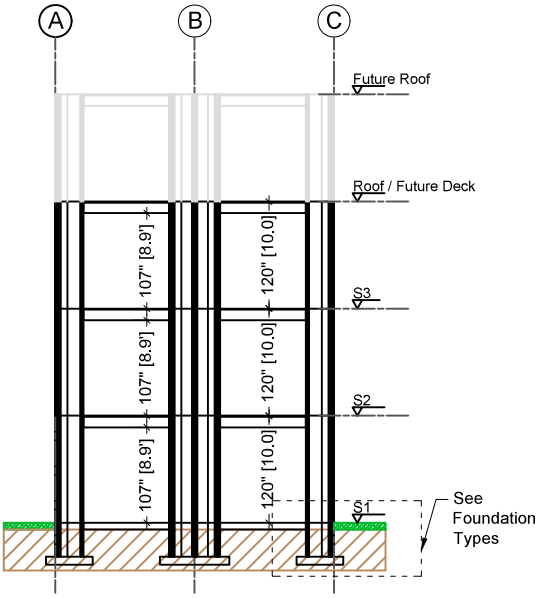
Jorge Cueto, Ph.D | Founder and Chief Executive Officer
Smart Walls Construction LLC
1576 Sweet Home Rd. Suite 216
Amherst, NY 14228
jcueto@smartwallsconstruction.com

ATTACHMENT #1



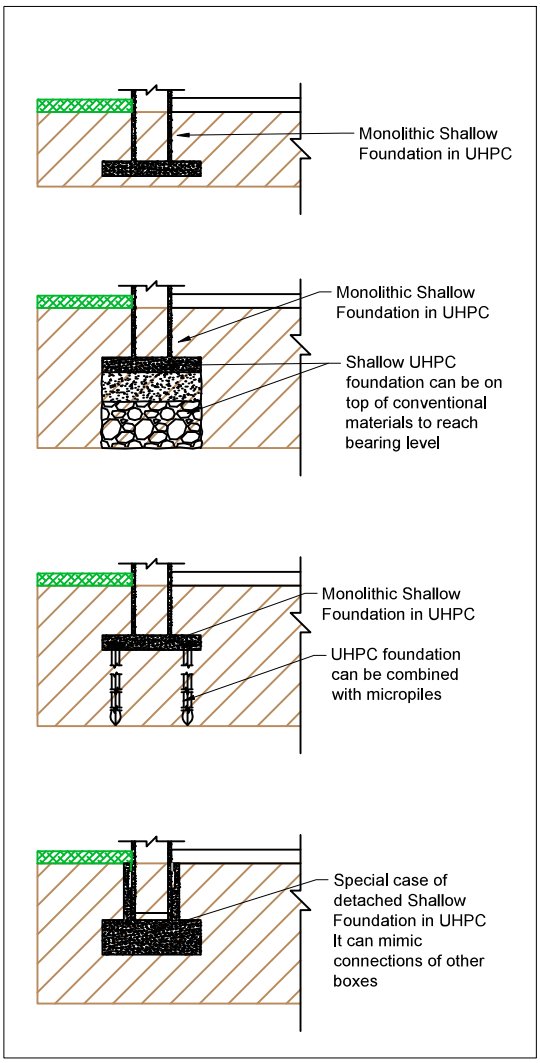
Plan View (Concept)

Scale N/A



Elevation View (Concept)

Scale N/A



Foundation Types (Concept)

Scale N/A

VERSION: GT1

PLAN NUMBER:

CONC:

Owner: Smart Walls Construction, LLC

Project: XXXXXX

Contents: Xxxxx Xxxxx

Drawn by: XX Date: 07/16/2021

Presented by: Xxxx Xxxx Date: 07/16/2021

Scale: INDICATE

File name: SW_GEOM_PREL.DWG

CONFIDENTIAL NOTE

CONFIDENTIAL

Drawing: Jorge Cueto

Drawing manager approval:

Check control

No.	DESCRIPTION	Ref.