MIDDLE EAST TECHNICAL UNIVERSITY
DEPARTMENT OF ARCHITECTURE / BUILDING SCIENCE PROGRAM

BS 536
STUDIES ON TALL BUILDINGS: DESIGN CONSIDERATIONS
Spring 2016-2017

Case Study: **Neva Tower 2**
by
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Neva Tower 2

Official Name: Neva Tower
Other Name: Plot 17-18
Construction Start / Expected End Date: 2013-2020[1]
Location: Russia, Moscow
Structural & Architectural Height: 338 m[1]
Height to Tip: 338 m[1]
Aspect Ratio: 11
Number of Floor : 77+4 (above ground + under ground) [1]
Building Function: Residential
Status: Under Construction
Architecture: FXFOWLE; SPEECH; HOK Inc. [1]
Structural Engineering: Halvarson and Partners[1]
Main Contractor: Renaissance Construction Company[1]
Structural Material: Reinforced Concrete
Structural System: Outriggered Frame System*

Figure 1: Neva Towers

* Classification according to *Tall Buildings: Structural Systems and Aerodynamic Form,* **BS536 lecture in METU**
[1] Neva Tower, CTBUH Skyscrapercenter
Figure 1: Source: Renaissance Construction

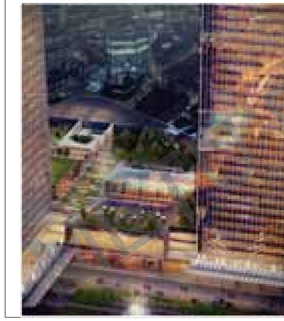
Location

Figure 2: Moscow International Business Center 2016

•Before construction began, the area had been an old stone quarry where most of buildings were old factories and industrial complexes that had been closed or abandoned. [1]
• This area will become the first zone in Russia to combine business activity, living space and entertainment. [1]

Figure 2: Retrieved from http://www.speech.su/projects/multifunctional_and_office_complexes/624-mnogofunkcionalnyy-administrativno-delovoy-kompleks-na-uchastkah-17-18-mmdc-moskva-siti.html
[1] Neva Tower, CTBUH Skyscrapercenter

Green Garden



• One of the strongest characteristic of the Project is its over 8,000 sq. m of green garden, including walking, entertainment and leisure zones. [1]

Figure 3: 3D view from conceptual design studies

Figure 3: Source: Renaissance Construction
[1] Neva Tower, CTBUH Skyscrapercenter

Structural System

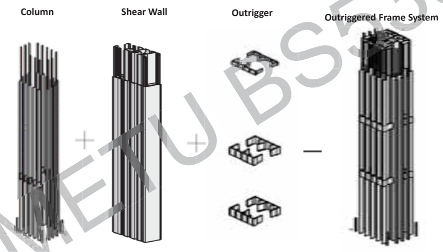


Figure 4: Structural System of Neva Tower 2 **drawn by K. Buğra TAŞÇI** [2]

[2] Renaissance Construction

Floor Plan

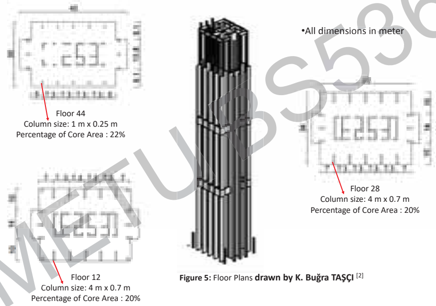


Figure 5: Floor Plans **drawn by K. Buğra TAŞÇI** [2]

[2] Renaissance Construction

Post-tension

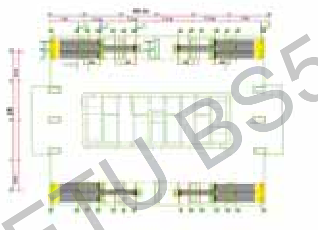


Figure 6: Post-tension application **modified by K. Buğra TAŞÇI** [2]

- The structural concept of two towers generally similar – both tower utilize reinforced concrete wall surround the core elements with reinforced and post-tensioned concrete floor framing. [1]
- Providing the outriggers greatly relieves forces on the core wall, allows the core to be more slender and more efficient within the floor plate, and minimize total material usage. [1]

[1] Neva Tower, CTBUH Skyscrapercenter
[2] Renaissance Construction

Outrigger

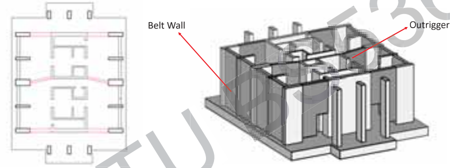


Figure 7: Level 30 outrigger plan (left) and level 30 outrigger sketch (right) **drawn by K. Buğra TAŞÇI** [2]

Belt Height: 9.3 m
Outrigger Height: 8.5 m/5.5 m

•70% maximum displacement reduction can be achieved by providing the first outrigger at the 30th level and the second outrigger and at the 50th level of the structure. [1]
•The top outrigger system is designed for not only lateral stiffness, but also has very critical role in progressive collapse scenarios. [1]

[1] Neva Tower, CTBUH Skyscrapercenter
[2] Renaissance Construction

Displacement Diagram of Story in Wind Loading

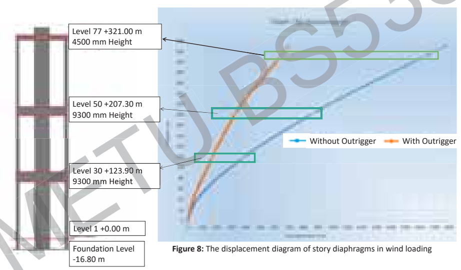


Figure 8: The displacement diagram of story diaphragms in wind loading

Figure 8: Source: Renaissance Construction, and
CTBUH Research Paper: Tall Building Design in Moscow City, CTBUH 2016 Shenzhen, Guangzhou, Hong Kong Conference

Wind Tunnel Test

•Roman Willams Davies & Irwin Inc.(RWDI) was retained by Halvorson and Partners, P.C. To study wind loading on the proposed Residential and Office Tower of the Renaissance Mixed-Use Development on Plot 17-18 in Moscow, Russia. [1]
•1:400 scale model [1]
•Every 5 floors with 33 sensors is about 1,060 in the model. [1]

Figure 9: Wind tunnel study model

Figure 9: Source: Renaissance Construction
[1] CTBUH Research Paper: Tall Building Design in Moscow City, CTBUH 2016 Shenzhen, Guangzhou, Hong Kong Conference

Foundation

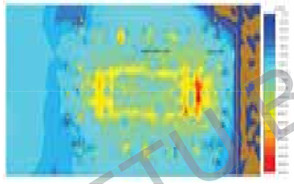


Figure 10: Soil stress diagram with interaction of slurry wall and structure

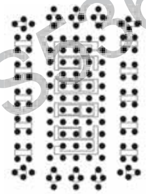
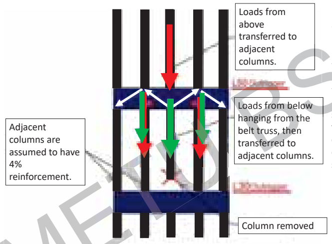


Figure 11: Pile and structure plan **drawn by K. Buğra TAŞÇI** [2]

•The piles and raft foundation were proposed for sharing of load between the piles and rock substrata. [1]
•The diameter of the piles is 1500 mm with 18 m length. [1]
•135 piles were applied in 2000 sq. m raft foundation. [1]

Figure 10: Source: Renaissance Construction
[1] CTBUH Research Paper: Tall Building Design in Moscow City, CTBUH 2016 Shenzhen, Guangzhou, Hong Kong Conference
[2] Renaissance Construction

Progressive Collapse Case Study



•The scenarios of progressive collapse include removal of one perimeter column, some part of the core wall and 100 sq. m slab area with loss of one tendon in the post tension slab. [1]
•The outrigger and belt wall system are very effective to keep the rest of the structural elements safe after removing elements in progressive collapse scenarios. [1]

Figure 12: Progressive collapse case study

Figure 12: Source: Renaissance Construction
[1] CTBUH Research Paper: Tall Building Design in Moscow City, CTBUH 2016 Shenzhen, Guangzhou, Hong Kong Conference

Construction Photos

References

• CTBUH, Skyscrapercity
• Retrieved from http://www.speech.su/projects/multifunctional_and_office_complexes/
• Renaissance Construction
• CTBUH Research Paper: Tall Building Design in Moscow City, CTBUH 2016 Shenzhen, Guangzhou, Hong Kong Conference