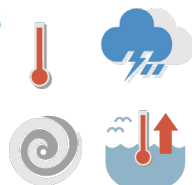


# Construction

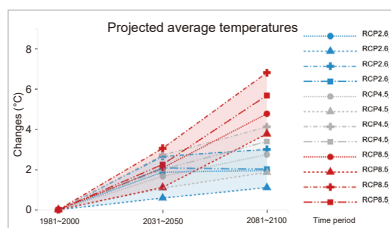
## Major Factors of Impacts

Rising temperatures, increased frequency and intensity of extreme weather events, increased number of strong typhoons, and rising sea levels

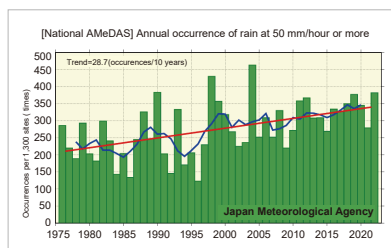


## Current Situation and Future Projections

Rising average temperatures, increased frequency and intensity of extreme precipitation events, and increased number of strong typhoons have been observed. These factors have led to increase frequency of river flooding, inland flooding and landslides, affecting buildings and infrastructure. If climate change progresses in the future, the extent and frequency of these impacts will further escalate.



Projected average temperatures (annual average temperature projections based on emission scenarios and climate models (difference from standard period)) Source: A-PLAT



Changes in the annual occurrence of precipitation of 50 mm/hour or more in Japan  
Source: Japan Meteorological Agency website (translated by NIES)

The number of emergency medical transports for heat stroke is on the rise. In the past five years, construction industry recorded the largest number of deaths and injuries due to heat stroke at workplaces (Source: Ministry of Health, Labour, and Welfare, 2020). By the end of this century, hours suitable for outdoor labor during the day in Tokyo and Osaka are projected to be 30-40% shorter than today (Source: National Institute for Environmental Studies, 2018).

## Adaptation

There are both hard and soft measures against increasingly severe weather disasters (torrential rains, typhoons, floods, etc.), as well as efforts to improve deteriorating labor environment at construction sites caused by climate change. Development of climate-resilient products, development of robots to save labor in construction, and other adaptation businesses are expected to grow.

Factors	Rising temperatures, increased frequency and intensity of extreme weather events			
	Core business	Markets/Customers	Adaptation business	
Management resources	Impacts on construction sites	Impacts on buildings and infrastructure	Market shifts	Product/Service development
	<ul style="list-style-type: none"> <li>Damage to construction sites</li> <li>Increased risk of causing damage to third parties</li> <li>Deterioration of working environment due to rising temperature, etc.</li> <li>Damage to suppliers</li> </ul>	<ul style="list-style-type: none"> <li>Damage and functional deterioration of buildings, infrastructure, etc.</li> </ul>	<ul style="list-style-type: none"> <li>Increased demand for buildings and infrastructure with climate resilience and high environmental performance</li> <li>Growing demand for construction for disaster prevention and mitigation, and for maintenance and restoration of buildings and infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>Increased demand for buildings and infrastructure with climate resilience and high environmental performance</li> <li>Deterioration of work environment</li> </ul>
Impacts				
Adaptation measures	Rising temperatures, increased frequency and intensity of extreme weather events			
	<ul style="list-style-type: none"> <li>Formulate and implement BCP</li> <li>Enhance resilience of buildings and infrastructure</li> <li>Construct buildings with climate resilience/high environmental performance</li> <li>Product development for climate resilient buildings and infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>Quick access to weather information and implement disaster prevention measures</li> <li>Locate critical facilities on upper floors</li> <li>Disaster prevention and mitigation work</li> <li>Maintenance and renewal work</li> </ul>	<ul style="list-style-type: none"> <li>Improve working environment</li> <li>Improve design standards to ensure performance</li> <li>Respond to restoration needs</li> </ul>	<ul style="list-style-type: none"> <li>Product development for buildings with high environmental performance including ZEB and ZEH</li> <li>Develop construction robots</li> </ul>



# Construction

The construction industry consists of the constructing sector, which constructs buildings including houses, schools, hospitals, and high-rise buildings, and the civil engineering sector, which develops infrastructure including roads, bridges, tunnels, dams, and water supply and sewage facilities.

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Factors	Increased temperatures, increased frequency and intensity of extreme weather events											
Management resources	Core business				Markets/Customers		Adaptation business					
Impacts	Impacts on construction sites		Impacts on buildings and infrastructure		Market shifts		Product /Service development					
	<ul style="list-style-type: none"><li>• Damage to construction sites</li><li>• Increased risk of causing damage to third parties</li><li>• Deterioration of working environment due to rising temperatures, etc. (resulting in a serious shortage of skilled workers and an increase in heat stroke)</li><li>• Increased number of days when construction site operations are difficult</li><li>• Disruption of the supply chain and obstacles to procurement of materials and equipment</li></ul>		<ul style="list-style-type: none"><li>• Damage of buildings, infrastructure, etc. (roads, bridges, tunnels, dams, water supply and sewage systems, power generation facilities, gas facilities, communication facilities, etc.)</li><li>• Functional deterioration of buildings, infrastructure, etc.</li><li>• Increased costs for disaster prevention and mitigation construction, maintenance and renewal construction</li><li>• Increased air conditioning load</li></ul>		<ul style="list-style-type: none"><li>• Increased demand for buildings and infrastructure with climate resilience and high environmental performance</li><li>• Growing demand for construction for disaster prevention and mitigation, and for maintenance and restoration of buildings and infrastructure</li><li>• Increased demand for water environment facilities (e.g., gray water utilization) due to decreased precipitation, increased air conditioning load</li></ul>		<ul style="list-style-type: none"><li>• Increasing demand for buildings and infrastructure with climate resilience and high environmental performance</li><li>• Deterioration of working environment</li></ul>					
Adaptation measures	Soft		Hard		Soft		Hard					
	<ul style="list-style-type: none"><li>• Formulate and operate BCP (strengthen disaster responses conduct disaster drills, etc.)</li><li>• Acquire weather information at an early stage and implement disaster prevention measures (formulate disaster prevention plans)</li><li>• Strengthen supply chain</li><li>• Obtain insurance coverage for construction work</li><li>• Develop and implement construction plans that take into account the impact of climate change (shift/shorten summer working hours)</li><li>• Raise awareness of heat stroke prevention</li><li>• Monitor heat index (WBGT)</li><li>• Promote manpower-saving and unmanned construction using ICT, AI, etc.</li></ul>		<ul style="list-style-type: none"><li>• Improve work environment (e.g., installation of resting facilities)</li><li>• Reinforce disaster prevention measures at construction sites</li><li>• Install emergency power supply, drainage pumps, and other disaster-prevention equipment</li><li>• Utilize construction robots</li></ul>		<ul style="list-style-type: none"><li>• Formulate and operate BCP (strengthen disaster response, conduct disaster drills, etc.)</li><li>• Revise design standards to ensure performance (air conditioning load, water resistance)</li><li>• Conduct regular inspections of buildings and infrastructure</li></ul>		<ul style="list-style-type: none"><li>• Enhance resilience of buildings and infrastructure (water-resistant construction, introduction of green infrastructure)</li><li>• Locate critical facilities on upper floors (power receiving and transforming equipment, emergency power generators, etc.)</li><li>• Improve design standards to ensure performance (introduction of high-performance thermal insulation, solar shading, highly efficient air conditioning, and energy-saving equipment)</li><li>• Implement flooding countermeasures by raising height of site, building pilots, using water barrier panels, watertight doors, etc.</li><li>• Strengthening countermeasures against performance deterioration</li><li>• Perform reinforcement, maintenance, and improvement work</li></ul>		<ul style="list-style-type: none"><li>• Construct buildings with high climate resilience/high environmental performance (plan, design, and construct buildings and infrastructure)</li><li>• Plan, design, and construct buildings with high environmental performance including ZEB, ZEH, etc.</li><li>• Perform disaster prevention and mitigation work</li><li>• Perform maintenance and renewal work</li><li>• Respond to restoration needs</li><li>• Participate in relocation projects</li><li>• Strengthen construction of water environment facilities (gray water utilization, etc.)</li></ul>		<ul style="list-style-type: none"><li>• Product development for climate resilient buildings and infrastructure (develop water-resistant buildings and materials that can be easily restored)</li><li>• Product development for buildings with high environmental performance including ZEB, ZEH, etc.</li><li>• Develop construction robots</li><li>• Develop smart cities</li><li>• Develop disaster detection and forecasting systems</li></ul>	
Details												
Effect	Low ~ Medium		Low ~ Medium		Medium		Medium ~ High		-			
Cost	Medium		Medium		Low ~ Medium		Medium ~ High		-			
Time span	Short ~ Medium		Short ~ Medium		Short ~ Long		Short ~ Long		-			
How to proceed with adaptation measures	<p><b>【Current approach】</b> The main focus is on countermeasures against increasingly severe weather disasters (torrential rains, typhoons, floods, etc.) and efforts to improve the environmental degradation of construction sites caused by climate change.</p> <p><b>【Climate change-aware approach】</b> Plan and design buildings and facilities with high climate resilience, taking into account future projections of climate change, including increased short duration intense rainfall and strong typhoons. Risks and opportunities should be identified based on the scenarios assumed by the company, and corresponding countermeasures should be incorporated into business plans.</p>											

【References】Ministry of the Environment (2018) "Climate Change Adaptation Plan" <http://www.env.go.jp/earth/tekiou/tekioukeikaku.pdf>, Ministry of Land, Infrastructure, Transport and Tourism (2018) "Ministry of Land, Infrastructure, Transport and Tourism Climate Change Adaptation Plan" <https://www.mlit.go.jp/common/001264212.pdf>, Ministry of the Environment (2020) "Assessment Report on Climate Change Impacts in Japan (Detailed)" <http://www.env.go.jp/press/files/jp/115262.pdf>, Ministry of the Environment (2022) "Climate Change Adaptation Guide for Private Sector - Preparing for Climate Risk and Surviving-" [https://adaptation-platform.nies.go.jp/private\\_sector/guide/index.html](https://adaptation-platform.nies.go.jp/private_sector/guide/index.html), Japan Meteorological Agency "[National AMeDAS] Annual occurrence of rain at 50 mm/hour or more" [https://www.data.jma.go.jp/cpdinfo/extreme/extreme\\_p.html](https://www.data.jma.go.jp/cpdinfo/extreme/extreme_p.html), National Institute for Environmental Studies (2018) "Estimating the effects of changing outdoor working hours as an adaptation measure to global warming - The effect of only changing the time of day on increasing heat stress is limited" <https://www.nies.go.jp/whatsnew/20181121/20181121.html>, Ministry of the Environment (2019) "Recommendations for business strategy planning using TCFD - Practical guide for scenario analysis incorporating climate-related risks and opportunities" [http://www.env.go.jp/policy/Practical\\_guide\\_for\\_Scenario\\_Analysis\\_in\\_line\\_with\\_TCFD\\_recommendations.pdf](http://www.env.go.jp/policy/Practical_guide_for_Scenario_Analysis_in_line_with_TCFD_recommendations.pdf), Ministry of Health, Labour and Welfare (2020) "Occurrence of Deaths and Injuries due to Heat Stroke in the Workplace in 2019 (Confirmed)" <https://www.mhlw.go.jp/content/11303000/000634421.pdf>, Suzuki-Parker A, Hiroyuki Kusaka "Future projections of labor hours based on WBGT for Tokyo and Osaka, Japan, using multi-period ensemble dynamical downscale simulations" Int J Biometeorology, 60(2), 307-10(2016), UK environmental Agency (2015) "Business Opportunities in a Changing Climate", Australian National University & Investor Group on Climate Change (2013) "ASSESSING CLIMATE CHANGE RISKS AND OPPORTUNITIES FOR INVESTORS"