Climate Risks Allocation in Public-Private Partnerships: A Practical Introduction

Transport & Infrastructure

GCA Learning from Practice

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GLOBAL CENTER ON ADAPTATION

This series of GCA Learning from Practice notes provides a practical reference to support the design and implementation of climate adaptation analyses. Drawing on the experience and lessons from GCA programs, each note focuses on a specific methodological component, offering guidance on key concepts, minimum standards, and recommended practices to strengthen the quality, consistency, and usability of analytical outputs.

Intended for practitioners, analysts, and decision-makers, the notes aim to balance scientific rigor with operational relevance. By translating experience into clear methodological benchmarks and actionable guidance, the series supports credible analyses and enables more informed planning, investment, and adaptation decisions.

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GLOBAL CENTER ON ADAPTATION

ABOUT THE GLOBAL CENTER ON ADAPTATION

The Global Center on Adaptation (GCA) is an international organization, hosted by the Netherlands, which works as a solutions broker to accelerate action and support for adaptation solutions from the international to the local, in partnership with the public and private sector, to ensure we learn from each other and work together for a climate resilient future.

AFRICA ADAPTATION ACCELERATION PROGRAM

GCA is providing technical assistance under the African Adaptation Acceleration Program (AAAP), a joint initiative launched by the GCA and the African Development Bank in 2021.

In Partnership with:

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Haskoning Enhancing Society Together

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ABBREVIATIONS

Acronyms	Definitions
AAAP	Africa Adaptation Acceleration Program
DBFOM	Design, Build Financing, Operation and Maintenance
GCA	Global Center on Adaptation
NDC	Nationally Determined Contributions
PPP	Public Private Partnership
SAG	Société Autoroutière du Gabon

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1. CONTEXT

The Government of Gabon has established investments in integrated resilient transport infrastructure as one of the key priorities under its Nationally Determined Contributions (NDCs). Among these priorities, the Transgabonairse Road is a flagship investment project as it fulfills an important role of connecting the capital Libreville with the rest of the country, allowing for the transport of people and goods and a more interconnected transport network.

The African Development Bank (AfDB) is currently supporting the Government of Gabon in preparing the investment, and financing for the first phase of the Transgabonaise road. First phase of this project is structured as a long term Public-Private Partnership (PPP) contract. The Sociéte Autoroutière du Gabon (SAG), owned by Meridiam, was selected by the Government for this project.

As a vital piece of infrastructure, it is important to consider the impacts of climate change in the planning, design, operations, and maintenance of the road corridor throughout its lifecycle. Within this context, the Global Center on Adaptation (GCA), through the Africa Adaptation Acceleration Program (AAAP), is collaborating with the AfDB and providing its technical expertise on climate adaptation to support the integration of adaptation and resilience measures within the project and especially in the context of a PPP.

Within this overall support, GCA has compiled a set of good practices in addressing climate risks in an infrastructure project when structuring a PPP, based on the example of a road project, with measures to consider in the initial contract framing and over the assets lifetime. The present knowledge paper provides an overview of generic considerations relevant while initiating and designing PPPs for infrastructure projects with the goal to achieve a balanced allocation of climate risks between contracting authority and private contractor. The set of recommendations applies in general, not directly related to any of the specifics of the Transgabonaise road project, which has been further addressed in a separated and tailored set of analysis and proposals, and includes a detailed assessment of climate risks, across type of hazards, to the assets and transport operations. The analysis has been carried by GCA with the consortium of firms including Haskoning and its partners Lobelia Earth, Rebel Group, GEO-GUIDE and ITP.

None of the information contained in this knowledge paper is directly related to the specifics of the transgabonaise road project, yet these considerations builds on the learnings from the project and discussions with the project partners, especially the Government of Gabon, the AfDB and the SAG.

2. PPP AND CLIMATE ADAPTATION

Before discussing how to integrate climate resilience in a PPP, it should be pointed out that PPP by itself is eminently conducive to addressing climate risks in an infrastructure project. In fact, compared to conventional procurement of infrastructure, all key features of a PPP by themselves are important entry-points to promote climate adaptation investments.

- PPP contracts have a very long duration, generally 20-30 years and more. Consequently, the investors in a PPP project need to consider all risks that may affect the costs and revenues of the project over this period, which include the risks caused by climate change. In contrast, the conventional procurement of infrastructure projects involves multiple contracts of short duration. First, an engineering firm is given the task of designing the infrastructure. Then, a construction company is appointed to build the infrastructure. Next, the maintenance and operation of the infrastructure is carried out by in-house staff of the procuring authority or outsourced through short-run maintenance contracts. Each of these contracts has a duration of only about 2-5 years. The contractors for each of these stages generally do not have a long-term perspective, which could make the case for integrating climate risk, because they are paid in the short term in function of the completion of their activities. The procuring authority, however, can and should have a long-term perspective, for instance in the definition of the design specifications, but is not automatically compelled to do so like the investor in a PPP project.
- In a PPP contract, most of the cost risks are allocated to the private contractor, both the initial construction costs and recurring maintenance and operational costs. As a result, the investors in a PPP project are concerned about all factors that may have an impact on these costs, especially cost increases. Investors have an increasing understanding of how climate can affect the cashflow of their investment and are more and more incentivized to take measures that reduce costs risks, such as integrating climate adaptation and resilience measures.
- In a PPP where the private contractor is remunerated by user payments (such as a toll road PPP), the investors can also be alert for the potential impact of climate risks on revenues, for instance through the non-availability of the infrastructure after a severe weather event. This provides another incentive for investments in climate resilience. The same effect is operative in government-pays PPP projects with availability-based payments.
- In a DBFOM project, all phases of the lifecycle of an infrastructure asset (design, construction, maintenance, and operation) are bundled in a single, integrated contract and entrusted to one private contractor. This integration allows the private contractor to implement a lifecycle cost optimization approach, which is particularly relevant for climate resilience. The contractor therefore has the incentive to invest in climate adaptation features (generally leading to higher design and construction costs) to reduce repair and business interruption costs from extreme weather events in the operation phase. As before, in a conventional procurement scenario (with separate design, construction and maintenance contracts) the procuring authority can and should adopt a lifecycle costing perspective but is not automatically compelled to do so like the investor in a PPP project.
- A PPP project is generally financed in large part by long-term non-recourse loans. Non-recourse loans depend, for their repayment and interest, solely on the cash flow generated by the project. The financiers therefore perform an in-depth due diligence assessment of the risks that may impair the debt service obligations during the loan tenor. In this way climate risks are brought to the attention of the investors in the PPP project. Investing in resilience will reduce the credit risk premium or may even be a condition for the financiers to grant a loan at all.

The conclusion of the above is that implementing a project through a PPP is by itself a powerful instrument for reinforcing the climate resilience of infrastructure projects.

However, using a PPP is, by itself, not sufficient for ensuring climate resilience. The benefits of PPP, also in the matter of climate resilience, do not come about automatically. They are obtained through an appropriate structuring and management of the PPP.

- The PPP contract must give proper incentives for resilience. Among other the clauses on force majeure and insurance are crucial in this regard. For instance, if the definition of force majeure is wide (i.e. includes most or all climate risks) and if the contracting authority compensates the private contractor for most of the adverse effects of an event of force majeure, then the latter has no incentive to invest in resilience.
- Although a PPP contract has a long duration, some assets have a lifetime that is even longer. This is the case, among others, for the construction of embankments and the digging of drainage channels, which are common components of climate adaptation measures. The long-term benefits of such investments are not fully captured in the PPP contract.
- While PPP contracts provide strong incentives to invest in climate resilience, the ability to do so depends on the availability of information about climate risks and adaptation options. In the proposal stage the resources and time for in-depth studies by the bidders are limited. Ideally, the bidders have access to reliable general climate risk data produced by knowledge institutes, as well as project specific data from the feasibility studies undertaken prior to the launch of the PPP tender procedure.
- The larger the uncertainty about climate risks and their consequences, the larger the probability of the occurrence of "winner's curse." This is the phenomenon that the bidders having the most optimistic forecast about the speed and consequences of climate change incorporate the least investments in climate adaptation in their proposals and therefore offer the lowest price and win the tender. When the consequences of climate change turn out to be more severe than anticipated, the costs are borne by the contractor (under a properly structured PPP arrangement with an adequate transfer of climate risks to the contractor). However, the users and the contracting authority are often also affected when substantial climate-related costs lead to contractor failure, service interruptions and a government bailout.

The objective of this knowledge paper is therefore to provide guidelines that ensure that the inherent benefits of PPP in the area of climate resilience are enabled and reinforced through proper structuring and management of the PPP contract.

These guidelines build on the inherent assumptions that climate risks to the project are first identified, and quantified by the project stakeholders, so their integration within the PPP contract can be data-driven and results-oriented.

3. CLIMATE RISKS ALLOCATION IN A CONTRACTUAL FRAMEWORK

3.1 Basic contractual options for the reinforcement of climate resilience

There are broadly two options that a contracting authority can take to reinforce climate resilience in infrastructure projects:

- Option 1: Transfer of climate risks to the contractor, so that the latter is incentivized to invest in adaptation measures.
- Option 2: Directly imposing climate resilience requirements on the design of the infrastructure and its maintenance and operation.

Both options have implications for provisions in the PPP contract, as well as for the procurement process. These implications are briefly introduced below and then discussed in more detail in the rest of the section.

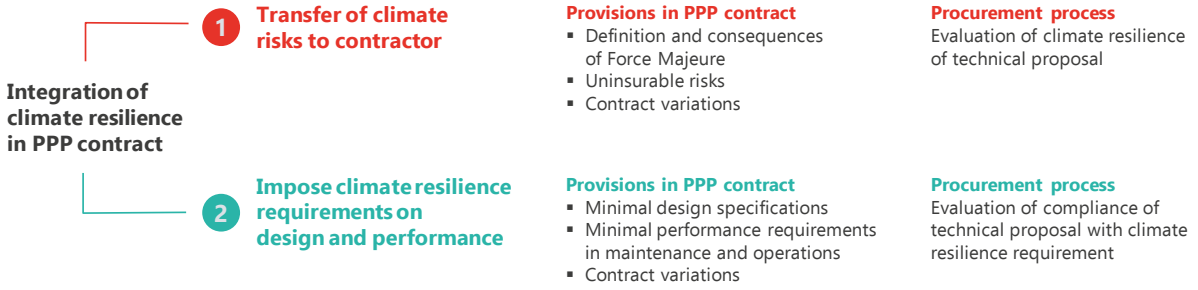

Figure 1: Contractual options for the reinforcement of climate resilience

Climate change increases the frequency and severity of extreme weather events, which can damage infrastructure and impair its availability, leading to cleanup and repair costs and revenue losses. Extreme weather events are generally considered as cases of force majeure in PPP contracts. The consequences of force majeure events are usually shared between the contracting authority and the contractor. To implement a cost-efficient level of climate resilience of the project, climate change risks must be allocated in a sufficient degree to the contractor. This may be achieved by excluding climate risks from the definition of force majeure or by providing that the consequences of force majeure are borne by the contractor. The provisions regarding the insurance of force majeure risks are also relevant in this regard because they determine to which degree and at which price climate risks can be insured as an alternative or complement to physical resilience measures.

The rate of climate change is uncertain. A faster increase of climate risks than expected at the time of the signature of the PPP contract cannot be excluded. Therefore, the adaptation requirements may also turn out to be greater than initially planned so that contract variations are needed to implement additional resilience measures.

Even when all climate risks are transferred to the contractor, the contracting authority may end up bearing a large part of the risks. If the contractor has substantially underestimated climate risks and has not sufficiently invested in resilience measures, then the costs of extreme weather events may financially cripple the contractor resulting in the inability to continue the operation of the infrastructure and possibly leading to bankruptcy. The contracting authority is then obliged to provide financial relief to the contractor or to take over the assets. Such a course of events cannot be excluded given the uncertainty of climate change and the winner's curse phenomenon described above. To minimize the probability of this happening, the contracting authority must require the bidders to demonstrate the degree of climate resilience of their technical proposals and evaluate their adequacy in the tender phase.

In the first option, described above, the implementation of climate resilience measures is pursued in an indirect way by incentivizing the contractor to adopt such measures to avoid or reduce expected climate

risk costs. In the second option the contracting authority directly imposes climate resilience requirements in the tender documents, as part of the output specifications. In the evaluation of the technical proposals the compliance with these requirements is verified. If, despite the imposed resilience measures, an extreme weather event causes damages, the uninsured costs and losses are compensated by the contracting authority or shared between contracting authority and contractor. As in the first option, contract modifications may be needed to undertake further resilience measures during the term of the PPP contract if climate change evolves faster than initially expected.

Both options reflect a different approach to the promotion of climate resilience in PPP infrastructure projects: direct versus indirect. However, the options are not fully exclusive and can be combined (or overlap) to some extent. For instance, the evaluation of the climate adaptation plans of the bidders in the first option may refer to minimal specifications and requirements that must be met for the proposal to be acceptable. In this way, these requirements are de facto imposed like in the second option.

Choice between options

The choice between both options depends on various project-specific circumstances.

- The type of PPP contract: user-pays (such as toll road concession) versus government-pays (availability DBFM). In user-pays contracts it is more customary that the contractor bears most of the force majeure risks, including climate risks, as the contractor is the economic owner of the project. This practice is in line with Option 1. In availability PPPs, on the other hand, the contracting authority is the economic owner of the project. In such projects, force majeure risks are generally shared or even mostly borne by the contracting authority. In that case Option 2 offers more assurance that climate resilience is included in the project design.
- The degree of uncertainty about climate risks and the effectiveness of adaptation measures. If the uncertainty about the future evolution of climate risks is high (due to inherent uncertainties of the local climate system, or due to lack of data and knowledge), then Option 2 is generally preferred. It reduces the risk of the winner's curse (the project being won by the bidder that has underestimated climate risks and plans the least investments in climate resilience) and ensures that a certain level of resilience is implemented. If the contracting authority assumes the climate risks nevertheless occurring (despite the resilience measures), then this approach also reduces climate risks for the contractor. In a situation of high uncertainty about climate change and the effectiveness of adaptation measures, this may be required for obtaining financing at acceptable conditions.
- The availability of insurance. If extreme weather events can be adequately insured (no substantial restrictions regarding eligibility and coverage of damages and business interruption costs), then Option 1 (transfer of climate risks) becomes more feasible. If not, Option 2 may be preferable.

3.2 Option 1: Transfer of climate risks to contractor

In this section the contractual framework provisions required for the effective allocation of (the majority of) climate risk to the PPP contractor are discussed. The following topics are covered:

- Force majeure
- Insurance
- Contract variations
- Evaluation of technical proposals

3.2.1 Force majeure

Introduction to issue

Climate change increases the frequency and severity of extreme weather events (strong wind, heavy rainfall, long periods of heat…). Extreme weather events generally fall under the definition of force majeure. As such, they entitle the contractor, when affected, to relief (temporary suspension of contractual obligations and exemption from penalties for non-performance) and, in some cases, to compensations for repair costs and revenues losses to be paid by the contracting authority.

The force majeure provisions in PPP contracts often reduce the incentive of the contractor to invest in climate resilience. To reinforce this incentive in line with Option 1 the definition of force majeure must be narrowed to exclude climate risks, at least to some degree. Alternatively, or additionally, the risk sharing provisions (relief and compensations) can be restricted for climate risks.

Definition of force majeure

Force majeure refers to events beyond the control of the contracting parties; and that render the performance of all, or a material part, of one party's obligations impossible. In PPP contracts one finds broadly two ways in which force majeure is defined.

The first way is an open-ended catch-all definition. Force majeure is defined as any event that is not reasonably foreseeable or avoidable, beyond the control of the affected party and cause the affected party to be unable to comply with contractual obligations.

Example of open-ended definition of force majeure[1]

In this PPP Contract, a "force majeure event" means any event or circumstance or combination of events or circumstances:

(a) beyond the reasonable control of the Party affected by such event, circumstance or combination of events or circumstances (the "Affected Party");

(b) which was not foreseeable or, if foreseeable, could not have been prevented or avoided or overcome by the Affected Party having taken all reasonable precautions and due care;

(c) which directly causes the Affected Party to be unable to comply with all or a material part of its obligations under this PPP Contract; and

(d) which is not the direct result of a breach by the Affected Party of its obligations under this PPP Contract or, in respect of the Private Partner, under any other Project Agreement.

[1] World Bank Group, *Guidance on PPP Contractual Provisions*, 2019 edition, p. 43.

The second way is by defining an exhaustive list of events that qualify as force majeure.

Example of closed definition of force majeure[2]

"Force majeure event" means the occurrence after the date of the PPP Contract of:

(a) plague, epidemic and natural disaster (storm, cyclone, typhoon, hurricane, tornado, blizzard, earthquake, volcanic activity, landslide, tsunami, flood, lightning, and drought)

(b) fire, explosion, or nuclear, biological or chemical contamination (other than caused by the negligence of the Private Partner, its contractors, or any Sub-contractor, supplier or vendor);

(c) war (whether declared or not), armed conflict, hostilities, invasion, act of a foreign enemy, act of terrorism, sabotage or piracy;

(d) civil war, riot, rebellion and revolution, military or usurped power, insurrection, civil commotion or disorder, mob violence, act of civil disobedience;

(e) radioactive contamination or ionising radiation; and

(f) general labor disturbance such as boycotts, strikes and lock-outs, go-slow, occupation of factories and premises, excluding similar events which are unique to the PPP Project and specific to the Private Partner or to its sub-contractors.

Sometimes both types of definition are combined: a limitative or illustrative list of events that qualify as force majeure under condition that they also meet criteria of non-foreseeability and unavoidability.

The open-ended definition allows in principle for the exclusion of climate-related weather events that are becoming more frequent and therefore foreseeable. Moreover, if climate adaptation measures are available, then the impact of these events on the project (damage, disruption of availability) is also avoidable. Under the open-ended definition these events would not qualify as force majeure.

The effectiveness of the above approach depends on the ability to evaluate the degree of foreseeability and avoidability of extreme weather events. In many countries extreme weather events are only considered as a case of force majeure when they are officially declared as a natural disaster. The qualification as a natural disaster is conditional on the severity of the event measured by wind strength, amount of rainfall within a certain period. The thresholds are based on the rarity of the event. For instance, in Belgium weather events are regarded to be exceptional and eligible for qualification as a natural disaster when they occur less than once in twenty years. In Japan similar criteria are applied.[3] However, in general the determination of the frequency of an event is based on historical data (for instance last 20-30 years). The impact of recent and future climate change is therefore not taken into account.

In the closed definition all listed events qualify as a force majeure, regardless foreseeability and avoidability. The transfer of climate risks to the contractor requires that extreme weather events are removed from the definition. In the standard DBFM contracts used by the Dutch Ministry of Public Works exceptional rainfall or wind strength is not included as a case of force majeure. Floods only qualify when caused by a dike breach outside the control of the contractor.

If climate risks and adaptation options have been examined in the feasibility studies of the infrastructure project, then the findings of these studies may be used to develop a customized force majeure definition for the project. Under this definition, extreme weather events would be qualified as a case of force majeure only if they are more severe than the optimal protection level calculated in the feasibility study and to the extent that the consequences (damages, revenue losses…) could not be avoided by the resilience measures identified in the feasibility study. The advantage of a customized definition is that it can take

[2] Adapted from World Bank Group, *Guidance on PPP Contractual Provisions, 2019 edition*, p. 43 and 46.

[3] World Bank Group (2017), Resilient Infrastructure Public-Private Partnerships (PPPs): Contracts and Procurement - The Case of Japan.

into account the expected climate risks in the future. In practice this approach may be close to Option 2 presented below (direct imposition of climate resilience measures).

Guidelines on the definition of force majeure

There are three approaches for excluding extreme weather events from the definition of force majeure to the extent that these risks have become "normal" due to climate change.

- The first approach is the use of an open-ended definition of force majeure. As explained above such an open-ended definition automatically excludes climate risks that are foreseeable and avoidable with appropriate adaptation measures. The effectiveness of this approach depends on the ability to objectively assess the foreseeability and avoidability of extreme weather events. Where available one may refer to the criteria of the official declaration of extreme weather events as natural disasters.
- The second approach is the use of a closed definition of force majeure which does not include extreme weather events. Or, alternatively, includes extreme weather events that meet the criteria for official declaration as a natural disaster.
- The third approach is a variant of the second approach. Instead of referring to official natural disaster criteria, the criteria for qualifying as a case of force majeure are based on the findings of the feasibility study and are tailored to the project. In the feasibility study an optimal protection level is determined based on an analysis of climate risks and available adaptation measures. Only events of a severity exceeding the protection level are qualified as a case of force majeure, and only the extent that the consequences could not be avoided or mitigated by appropriate adaptation measures. This approach allows to take into account expected future climate risks (official natural disaster criteria are generally based on historical data).

Consequences of force majeure

The occurrence of a force majeure event generally has three consequences in a PPP project.

First, the contractual obligations of the affected party are temporarily suspended. If the force majeure event occurs during the construction period, the contracting authority allows a postponement of the completion date. In the exploitation phase the contracting authority does not apply penalties for non-availability of the infrastructure or other performance shortcomings.

Secondly, the contractor, when affected, may receive a compensation from the contracting authority for damages and revenue losses. The compensation is meant to help restoring the financial equilibrium of the contractor after the force majeure event. While relief from contractual obligations is relatively standard across PPP projects the extent of compensation granted varies between countries and types of projects.

- In user-pays PPPs (like a toll road) it is customary to allocate the force majeure risks fully to the contractor. The contractor is fully incentivised (and forced by its financiers) to take all available preventive and mitigating actions, take out insurance, and keep financial reserves to bridge revenue interruptions. Since the financial costs of all force majeure risks are allocated to the contractor, the exact definition of force majeure is less important from the perspective of the contracting authority. However, definition of force majeure remains relevant for the sharing of climate risks between the contractor and users. In cases of force majeure the contractor is usually temporarily relieved from contractual obligations, including service obligations to users. Furthermore, many user-pays PPP contracts contract allows the contractor to increase user tariffs and recover some of the climate-induced costs and losses from users.4
- In government-pays PPP project (availability-based DBFM) the damage costs are generally shared between the parties, and sometimes even largely paid by the contracting authority (to the extent that the damages are not insured). In addition, the availability payments are often continued during the

[4] Suggested in World Bank Group (2023), Climate Toolkits for Infrastructure PPPs – Road Sector (https://www.ppiaf.org/feature/new-climate-toolkits-infrastructure-ppps).

repair and recovery period although the road is not available. In this way the contractor can honor its financial obligations to financiers and subcontractors. A deduction corresponding to the variable costs may be applied, but the fixed part (debt service and fixed operating costs) is ensured. This practice facilities the financing of the project but reduces the incentive for the contractor to invest in climate resilience. Since payments to financiers are protected, they will be less concerned about climate resilience in their due diligence.

Thirdly, when the force majeure event persists for a long time (3 to 6 months), then each party has the right to terminate the contract. The value of the termination payment paid by the contracting authority to the contractor varies between countries and types of projects. As with damage compensations (discussed above) the termination payment tends to be more generous in government-pays PPP projects than in user-pays PPPs. The consequence is that in user-pays PPP projects the contractor is generally more incentivized (and more under pressure from its financiers) to invest in climate resilience.

Guidelines on the consequences of force majeure

If the PPP contract allocates all or most cost and revenue impact of force majeure events to the contractor, then the latter is automatically incentivized to integrate climate resilience in design and construction. It is then not strictly necessary to narrow the definition of force majeure. This case often occurs with user-pays PPPs (such as toll road concessions).

In government-pays PPPs (DBFM based on availability) the PPP contract generally allocates a large part of the cost and revenue impact of force majeure events to the contracting authority. As a result, the incentive to invest in climate resilience is weakened. The most practical solution is narrowing the definition of force majeure so that climate risks are partially or wholly excluded. This solution was discussed above. Limiting the extent of sharing of force majeure risks with the contractor is less recommended because it would also affect the allocation of other force majeure risks where this may not be appropriate.

3.2.2 Insurance

Introduction to issue

The sharing of cost and revenue risks in cases of force majeure only applies to risks that are not insurable on reasonable terms. The availability of insurance for climate risks therefore influences the feasibility of transferring these risks to the contractor.

The contracting authority often bears non-insurable risks in PPP contracts. This reduces financing costs and may even be an essential condition for the bankability of the project. However, the insurability of climate risks depends on the climate resilience of the project. To reinforce the climate resilience of infrastructure projects the contracting authority should not accept to bear non-insurable climate risks that would be insurable if the contractor took appropriate resilience measures.

The contractor has the responsibility for taking out appropriate insurances to protect its investment in the project. Its financiers will require adequate coverage and verify this as part of the due diligence. In most PPP contracts the contracting authority also prescribes the minimum insurance package that the contractor must take out. This ensures that the contractor is sufficiently insured to cope with most risks without serious financial difficulties that impair the continuation of the services. The minimum insurance package generally includes extreme weather events (as well as other natural disasters).

Climate-related extreme weather events (floods, storms, and rainfall) are usually insurable, although availability and pricing depend on the local context. Also, there may be limitations (“sublimits”) on the overall payout available for specific risks.

In markets where adequate insurance for climate risks is available, these risks can be allocated to the contractor without difficulty. The contractor has an incentive for increasing the climate resilience of the project if this permits to obtain better insurance terms.

Large uninsurable risks are generally borne by the contracting authority. Otherwise, the project may not be able to secure financing, or only at the cost of a large risk premium in the interest rate. Because of changing climatic conditions, climate risks grow over time. It is therefore possible that a climate risk becomes uninsurable during the term of the PPP contract. In that case the PPP contract typically provides that both parties negotiate a mutually satisfactory solution for managing the risk. If no solution is found, the risk is assumed by the contracting authority as an insurer of last resort. Generally, the contracting authority also has the option to terminate the PPP agreement (with the provision of a termination payment, as in the case of prolonged force majeure), either when the risk becomes uninsurable or later when the uninsurable risk has materialized.

Uninsurability is not an absolute fact. It does not mean that the risk cannot be insured at all, but that:

a. Insurance is unavailable on the international insurance market by insurers of an adequate credit rating/reputable insurers of good standing; or

b. Insurance premiums are prohibitively high, i.e. at such a level that the risk is not generally being insured against by similar contractors.[5]

In this regard, the procedure for uninsurable climate risks in the PPP contract should provide for an assessment of the potential of additional resilience measures to maintain insurability. If the additional measures entail costs, then a contract variation must be negotiated (see following section).

Climate change may trigger the development of new insurance products aimed at the efficient coverage of climate risk, such as catastrophe bonds.[6] Consequently, a climate risk that is not insurable at contract close may becomes insurable during the term of the PPP contract. The contractor should therefore be required to periodically consult the insurance market to check whether insurance products are available for uninsured project climate risks.[7]

Guidelines on insurance of climate risks

Insurance against climate-related extreme weather events must be included in the insurance package prescribed by the PPP contract (already common practice today).
If adequate insurance for climate risks is available, these risks can be allocated to the contractor, either by excluding them from the definition of force majeure, or by providing that damages and revenue losses from climate-related extreme weather events are entirely borne by the contractor.

The verification of the uninsurability of climate risks should consider whether climate resilience measures can be taken that would allow to maintain insurability. Only if such measures are found to be unavailable should the contracting authority accept to assume uninsurable climate risks.

[5] World Bank Group, *Guidance on PPP Contractual Provisions*, 2019 edition, p. 41.

[6] Large insured losses caused by Hurricane Andrew in 1992 led to a decline of the supply of reinsurance and increasing premiums. In response the market for catastrophe bonds started to develop as an alternative to conventional reinsurance. Catastrophe bonds allow to spread natural disaster risks over a wider group of investors. This in turn allows to insure against events with higher losses. (ECB and EIOPA, 2023, *Policy options to reduce the climate insurance protection gap - Discussion Paper*).

[7] A similar requirement already exists in many PPP contracts regarding risks that have become uninsurable during the term of the contract and that have been assumed by the contracting authority as insurer of last resort. In return, the contractor must periodically consult the insurance market to see if the risk can be insured again on acceptable conditions.

3.2.3 Contract variations

Introduction to issue

The rate (speed and intensity) of climate change is uncertain. A faster increase of climate risks than expected at the time of the signature of the PPP contract cannot be excluded. Therefore, during the PPP contract term the adaptation measures required may turn out to be greater than initially planned. The parties must then negotiate a contract variation to undertake additional investments in climate resilience.

Infrastructure PPP contracts have a very long duration (20-30 years or more). In this long period, the service requirements may well change, for instance because of changing user needs, regulatory changes, or technological changes. Therefore, PPP contracts generally contain provisions for contract variations. Contract variations may relate to changes of contractual provisions or performance standards but can also involve additional construction works provided these are in the scope of the PPP contract.

Climate change is also a source of changing requirements. A faster increase of climate risks than expected at the time of the signature may lead to a need for additional investment in climate resilience. In some instances, this may be required to maintain the insurability of climate risks or prevent the increase of insurance premiums. The contract variation provisions in the PPP contract can be used to integrate the additional resilience measures in the PPP project.

In function of the initiating party two types of contract variations are distinguished:

- Government-initiated (i.e., initiated by the contracting authority)
- Private partner-initiated (i.e., initiated by the contractor)

The default is that each party bears the cost of the variations it initiates, but PPP contracts generally allow that parties make other arrangements.

In the case of the implementation of climate-resilience-enhancing measures and investments, a deviation from the default may be indicated. The costs of such measures should be paid by the party that bears the climate risks (or shared in proportion with the fraction of climate risks that is borne by each party), and therefore benefits from the reduction of climate risks achieved by the additional resilience measures.

As explained above, most of the force majeure risks (including climate risks) are generally borne by the economic owner of the infrastructure, i.e. the government in the case of availability-based DBFM projects and the private partner in the case of user pays PPPs (like toll-road concessions).

In the case of a toll road concession the contracting authority should allow the contractor-concessionaire to recover the costs from users by increasing toll tariffs. The additional resilience requirements are triggered by a faster increase of climate risks than anticipated at the signature of the concession contract. Hence, because of climate change, the life-cycle costs of the road are higher than initially expected. It is fair that these costs are charged to the users of the road. The concessionaire can nevertheless choose to increase the toll tariffs by less than the costs for commercial reasons.

For each contract variation, the initiator must provide to the other party a detailed proposal with a description of the works and any other changes, as well as a comprehensive estimate of the costs and benefits. This proposal serves as the basis for the determination of any compensations or tariff adjustments. Private partner-initiated contract variations must be evaluated and approved by the contracting authority. In the case of variations related to climate resilience, this evaluation includes an assessment of the impact on climate risks. For this, the contractor as well as the contracting authority will need adequate climate change expertise (respectively for preparing and evaluating the contract variation proposal).

In general, the approval of contract variations by the parties cannot be withheld (provided there is an agreement on the cost allocation), unless the proposed works are outside the scope of the original PPP contract or conflict with relevant laws and regulations. If the standard provisions in the PPP contract with respect to the approval of contract variations are insufficiently clear, an explicit in principle approval of variations related to climate resilience should be included.

Optimizations of the implementation of contract variations related to climate resilience can be envisaged, when feasible and appropriate.

- Resilience measures in pre-defined contract variations: Consider the situation where the feasibility study of the PPP project identifies several resilience measures that are not cost-efficient given the current state and expected evolution of climate risks but may be later in the term of the PPP contract. In this situation, it may be advantageous to include the measures as pre-defined variations in the PPP contract. The bidders are asked to quote a price for the implementation of the variation in their financial proposals. The price quoted by the winning bidder is taken over in the PPP contract. The triggers and procedure for implementing the variation and allocation of costs and benefits are also defined in the contract. This would enable an accelerated procedure for the implementation of the variation when the need for additional climate resilience has become apparent. It would still be necessary to update the specifications and pricing of the measures, but the base would already be defined in the PPP contract.[8]
- Contingency funds for climate risks: The concept of the climate contingency account (CCA) is inspired by the maintenance reserve accounts (MRA) that are commonly used in PPP projects. The MRA consists of cash balances (or in advanced PPP markets increasingly credit lines) set aside to cover a project's maintenance and repair expenses, in particular periodic heavy maintenance works. Like with a MRA, the funds or credit lines in a CCA would be used to cover the costs of additional investments in climate resilience when these turn out to be necessary or advisable. The CCA ensures that investment funds are available or can be rapidly mobilized, thereby facilitating and accelerating the implementation of additional climate resilience investments. If pre-defined climate adaptation variations are defined in the PPP contract (see above) the estimated investment costs of these could serve as basis for the determination of the value and buildup of the CCA. The maintenance of a CCA has a cost. The reserve cash balances increase the capital requirements of the project and must be financed. A CCA in the form of a standby credit facility comes with a fee. The benefits of the CCA in terms of funding certainty must be weighed against these costs.[9]

Guidelines on contract variations related to climate resilience

The procedure for contract variations, generally provided for in PPP contracts, can be used for implementing additional climate resilience measures the need for which only become apparent later in the term of the PPP contract.

The costs of the additional measures must be borne by the parties in proportion to the fraction of the climate risk costs that they bear (which is largely determined by force majeure provisions -see above). In practice this means that the costs are generally borne by the contracting authority in the case of availability-based DBFM projects and by the contractor in toll road concessions. In the latter case, the concessionaire should be permitted to increase toll tariffs to recover the net cost (after deduction of benefits, for instance lower insurance premiums) from the users of the road.

Several approaches should be considered (and adopted where feasible and appropriate) to facilitate the implementation of additional climate resilience investment during the PPP contract:

The inclusion of pre-specified and pre-priced contract variations related to resilience investments that are expected to become required with a reasonable probability. This reduces the efforts of developing, examining and approving the variations when they become advisable.

The establishment of a climate contingency account (CCA) for the financing of additional climate resilience investments during the term of the PPP contract.

[8] This approach is suggested for contract variations in general in the APMG PPP Guide, chapter 8, section 7.3 "Managing Government-Initiated Variations" (https://ppp-certification.com/ppp-certification-guide/7-variation-management).

[9] The idea of the CCA is introduced in recently published guidance on climate adaptation in infrastructure PPP projects: World Bank Group (2022), *Climate Toolkits for Infrastructure PPPs*. This publication is part of a set of toolkits for the integration of climate mitigation and adaptation into PPP project structuring in a range of infrastructure sectors (https://www.ppiaf.org/feature/new-climate-toolkits-infrastructure-ppps). The CCA concept is new and no applications are known.

3.2.4 Evaluation of technical proposals

Introduction to issue

Even when all climate risks are transferred to the contractor, the contracting authority may end up bearing a large part of the risks. As explained above the government is the insurer of last resort. When climate risks become uninsurable, the contracting authority must take over the insurance for the project to be able to continue. In the case of prolonged force majeure, the PPP contract is terminated, and the contracting authority takes over the assets in return for a termination payment to the contractor. To avoid the above situations from occurring, the contracting authority wishes to make sure that the contractor has properly taken into account of climate risks in the design of the infrastructure, as well as in maintenance and operation plans.

One of the key characteristics of a PPP, as well as one of the sources of the benefits of a PPP, is the design freedom of the contractor. The contracting authority specifies the requirements that the infrastructure must achieve. How these requirements are achieved is left to the design freedom and creativity of the bidders.

Nevertheless, the contracting authority wishes to make sure that the technical proposal of the contractor is feasible and able to meet the specified requirements before signing the PPP contract. It would be highly unpractical, as well as very costly, to award the contract to a contractor and to only discover later in the term of the contract that the contractor's proposal is unfit for requirements and that the PPP contract consequently must be terminated.

In the option discussed here (transfer of climate risks to contractor) the contracting authority does not directly impose climate resilience features and measures (as in the second option discussed below). The technical approach for integration of climate resilience in the project is left to the design freedom of the contractor. However, the contracting authority should verify that the technical proposal of the contractor is feasible and sound. The request for proposal instructions should therefore require, as part of the technical proposal submission, a climate resilience plan. The climate resilience plan must at least describe:

- The assumptions regarding the evolution climate risks during the term of the PPP contract.
- The measures taken to reduce the impact of climate-related extreme weather events on damage costs and availability and revenue losses, both preventive (through appropriate resilient design) and reactive (emergency preparedness and response plans for when extreme weather events cause damage and service interruption despite the preventive design measures).
- Estimates of the cost and expected effectiveness of these measures.
- Estimates of costs and revenues losses of climate-related extreme weather events that are expected to occur despite the resilience measures (residual climate risks).
- The ability of the contractor to bear the financial costs of residual climate risks, and the robustness of the financial plan for residual climate risks.

The contracting authority may impose a minimum protection level (definition of the severity or frequency of extreme weather events that the infrastructure should withstand) in the request for proposal instructions or refer to specific risks identified in the feasibility study and that should be addressed in the resilience plan.

The quality and realism of the climate resilience plan is one of the evaluation criteria of the technical proposal. How many points are accorded to this criterion depends on the importance of climate risks in the project. If climate risks are significant, one would expect about the same weight as for other environmental and social impacts. The more important climate risks are, the higher the weight that should be accorded to this criterion. In addition, a minimal score can be prescribed. If the climate resilience plan does not achieve the minimal score (meaning it contains substantial shortcomings regarding completeness and realism) the proposal is deemed unacceptable regardless of the overall score.

Alternatively, climate resilience could be included as a sub-criterion under each of the other technical criteria. This means that the parts of the submission that cover the construction, operations and maintenance plans would include climate resilience measures and how the bidder aims to address

climate risks.[10] However, this fragmented approach makes an integrated assessment of the coherence and adequacy of the climate resilience plan more difficult. This approach is therefore only advised when climate risk is present and should be addressed in the technical proposal but is not considered sufficiently important to justify a separate evaluation criterion.

The contracting authority's proposal evaluation team must have sufficient climate change and adaptation knowledge to be able to evaluate the feasibility and realism of the proposed climate resilience plan.

Additional suggestion: Integration of climate resilience in the RFQ

Most PPP tender procedures contain two stages: a Request for Qualification (RFQ) stage and a Request for Proposal (RFP) stage. In the first stage, the potential bidders submit an application that demonstrates their technical and financial capability of undertaking the project. The candidates meeting the prequalification criteria defined in the RFQ document are invited to the RFP stage. This approach ensures that only sufficiently qualified bidders participate in the RFP stage and no time is wasted on the preparation and evaluation of proposals of unqualified bidders.

The technical capability of candidates is usually demonstrated by providing evidence of reference projects with similar characteristics as the project being tendered. If climate risks are important, then one could consider including experience managing projects with a similar climate risk profile as a qualification criterion. In practice this would mean that one or more of the reference projects that is submitted should show "past experience with projects with a similar climate risk profile, as well as with the effective mitigation of climate risks in such projects."[11] A similar climate risk profile can be defined as the same type of extreme weather events, same order of magnitude of probability of occurrence and damages and/or requiring similar adaptation measures.

Integration of climate resilience in RFQ criteria should only be considered when climate risks are very important in the project, and when there are sufficient potential bidders able to demonstrate the required experience. Otherwise, the number of bidders may be too low to generate sufficient competition among bidders, generally leading to lower value-for-money.

Note that the RFQ stage is a preliminary step looking at past experience. In their final proposals, bidders will have to include a sound and adequate climate resilience plan. Proposals without such a plan will be rejected in the RFP stage.

Guidelines on evaluation of climate resilience in technical proposals

Even when climate risks are mostly allocated to the contractor, the contracting authority should evaluate the adequacy of the climate resilience plan of the bidders. For this purpose, the bidders must submit a climate resilience plan as part of their technical proposals.

In the option discussed here (transfer of climate risks to contractor) the contracting authority does not directly impose climate resilience features and measures (as in the second option discussed below). The development of the climate resilience plan is left to the design freedom of the contractor. Hence, the evaluation of the climate resilience plan does consist of the verification of the presence of specific design features but involves an overall assessment of the quality and realism of the climate resilience plan, including the coherence with the financial plan. The goal of the contracting authority is to verify that the contractor has appropriately addressed climate risks so that the probability that the government must intervene as insurer of last resort is minimized.

The weight of the climate resilience criterion depends on the importance of climate risks. If climate risks are important one would expect about the same weight as for other environmental and social impacts,

[10] Inter-American Development Bank (2020), *Climate Resilient Public Private Partnerships: A Toolkit for Decision Makers*. Both approaches for the evaluation of the integration of climate resilience in the evaluation of PPP proposals are presented and elaborated on p. 108 et seq.

[11] Inter-American Development Bank (2020), Climate Resilient Public Private Partnerships: A Toolkit for Decision Makers, p. 99 et seq.

and also a minimal score that must be attained (so that technical proposals with a materially deficient climate resilience plan can be discarded).

The contracting authority must make sure that the proposal evaluation team contains experts with sufficient climate change and adaptation expertise.

3.3 Option 2: Directly imposing climate resilience requirements

Introduction to issue

If the uncertainty about the future evolution of climate risks and/or the effectiveness of climate adaptation measures is large, then it may not be feasible to allocate climate risks to the contractor. In this case, the only way to implement climate resilience measures is by directly imposing them in the technical terms of reference. This has implications for:

- The definition of force majeure.
- The technical output specifications.
- The evaluation of the technical proposals.
- The contract variations regime.

In situations with large uncertainty about the future evolution of climate risks and/or the effectiveness of climate adaptation measures (due to inherent uncertainties of the local climate system, or due to lack of sufficiently reliable data and knowledge) it may not be possible to allocate climate risks to the contractor. There are several difficulties:

- The contractor is unable to design an effective climate resilience plan.
- The contracting authority is unable to reliably evaluate the adequateness of the resilience measures proposed by the bidders.
- The residual climate risks (i.e., the risks that remain after resilience measures are implemented) are uncertain and may be high. This may make the obtaining of financing for the project difficult or even impossible.

In this situation the only feasible approach to deal with climate risks is the following:

- The contracting authority imposes the design specifications and the resilience measures that need to be taken. These specifications and measures are based on the findings of the feasibility study. They are expected to yield cost savings compared to doing nothing. However, due to the large uncertainty about climate risks their exact effectiveness and the magnitude of the residual risks cannot reliably be determined.
- The contracting authority (through cost compensations) or the road users (through toll tariff adjustments) bear the majority of residual risks. In a situation of large climate risk uncertainty, this is the only way to find financing on reasonable terms for the project.

The implications for the contractual framework are discussed here below.

Force majeure

No exclusions from the definition of force majeure are needed. The standard definition of force majeure in which all climate-related extreme weather events are included, is consistent with the direct imposition of climate resilience requirements in the output specifications of the project. If these requirements are met, then all residual risks can be considered as not reasonably foreseeable or avoidable.

The financing of the project on acceptable terms requires a sufficiently predictable and stable risk environment for the contractor. In a situation of large and uncertain residual climate risks this implies that the costs and losses of climate-related force majeure events are not borne by the contractor. Instead, they should be allocated to either the contracting authority or the road users.

The first option is advised for availability-based DBFM contracts, where the contracting authority is the economic owner of the infrastructure. It implies that the contracting authority (i) compensates the contractor for uninsurable damages, and (ii) maintains the payment of the availability fee during the repair period, even when the road is partially or entirely unavailable (and provided that the contractor takes appropriate emergency measures as prescribed by the emergency preparedness and response plan). A deduction of the availability fee corresponding to the variable costs may be applied, but the fixed part (debt service and fixed operating costs) is maintained so that the contractor can honor its financial obligations to financiers and subcontractors.

The second option is advised for toll-road concessions, where the contractor is the economic owner of the infrastructure. The contracting authority must evaluate and approve the requested increase of the toll tariff so that it matches the actual costs and losses of the contractor.

Output specifications

In this option the climate resilience requirements are directly imposed by the contracting authority in the output specifications. These output specifications are included in the RFP and will become part of the PPP contract (generally in the form of a technical annex of the PPP contract).

A distinction must be made between design/construction specifications and maintenance/operational specifications.

The design/construction specifications relate to the specifications of the infrastructure itself and the integration of resilience features therein. There are two ways to define these specifications. The first is by defining the maximum severity of extreme events that the infrastructure must be able to withstand. The choice of design features that are required to meet the requirements is left to the contractor.

Note that the design specifications must be consistent with the definition of force majeure. The example below shows the definition of severe weather events that will be regarded as force majeure events. The same definition should be used as basis for the minimal infrastructure specifications: the infrastructure should be able to withstand any event less severe than the threshold for declaration as a case of force majeure.

Example of definition weather events regarded as force majeure[12]

Heavy rain

- Rainfall of 80 millimetres in 24 hours or more.
- Even if the rainfall is below the above standard, it is considered heavy rain if the hourly rainfall measured at the nearest weather observation station is 20 millimetres or more.

Storm

- Wind speed of 15 meters per second or more (average in 10 minutes).

The second approach is by exactly describing the resilience features that must be constructed, for instance a minimum level of elevation of earthworks or the discharge capacity of culverts and drainage channels.[13]

Which approach is chosen depends on the available information on climate risks and adaptation options in the project feasibility studies. The first approach is closer to the nature of PPP projects (with design freedom for the contractor) and is preferred when possible.

[12] Contract documents of Aichi Toll Road Project, cited in World Bank Group (2017), *Resilient Infrastructure Public-Private Partnerships (PPPs): Contracts and Procurement - The Case of Japan*, p. 10 and p. 48.

[13] A third approach is the specification of a protection level, expressed in terms of the frequency of the event that the infrastructure must be able to withstand (for instance heavy rainfall with a frequency of less than one in twenty years). However, in a situation of large uncertainty about climate risks it is likely not possible to determine nor evaluate the design requirements that correspond with a given protection level.

The maintenance/operational specifications relate to the preparedness and response when extreme weather event outside the design specifications occurs. The output specifications prescribe the minimum performance in terms of availability and recovery time.

Example of performance indicators correlating hazard level intensity with the level of service[14]

Heavy rain (as defined in previous example)

- 50% availability of network.
- Recovery time to 90% of functionality: 48 hours.

Storm (as defined in previous example)

- Recovery time to 90% of functionality: 6 hours..

Evaluation of technical proposals

In the evaluation of the technical proposals the contracting authority must verify the compliance with the minimal climate resilience requirements, like as with any other minimal technical requirements. Compared to the first option (transfer of climate risks to the contractor) less climate change expertise is needed for the evaluation. The climate resilience requirements are already translated in concrete technical specifications. The verification of the compliance with the specifications can therefore be accomplished with engineering expertise.

The bidders must submit as part of their technical proposals an emergency preparedness and response plan. These plans are evaluated with respect to their compliance with the corresponding minimum performance requirements.

Contract variations

Like in option 1, additional climate resilience measures may turn out to be necessary in the course of the PPP contract, as climate change evolves or more information about the extent of climate risks becomes available. Like in option 1, the additional measures can be implemented through contract variations. The same issues come into play as discussed above for option 1.

Guidelines on option 2 (direct imposition of climate resilience requirements)

If the uncertainty about the future evolution of climate risks and/or the effectiveness of climate adaptation measures is too large for option 1 to be feasible, then the only option to reinforce the climate resilience of the project is by directly imposing climate resilience requirements in the technical terms of reference. These requirements may consist of:

- Definition of climate-related extreme weather events that the infrastructure must be able to withstand.
- Definition of design specifications or features that must be implemented in the infrastructure.
- Minimal performance levels regarding infrastructure availability, response and recovery times when extreme weather events outside the minimal design specifications occur.

The contracting authority verifies the compliance of the technical proposal of the bidders with these requirements (in particular, the technical designs and the emergency preparedness and response plans submitted by the bidders). Non-compliant proposals are discarded.

The residual risks (i.e., the risks that remain after resilience measures are implemented) must be considered as force majeure events with the costs and losses borne by the contracting authority (for availability-based DBFM projects) or by the users through toll tariff increases (for toll road concessions).

[14] Fictitious example cited in World Bank Group (2022), *Climate Toolkits for Infrastructure PPPs*, p. 268.

4. SERVICE STANDARDS PERFORMANCE METRICS AND TARGETS

Introduction to issue

In the operational phase the performance of road PPPs is governed by service level standards. The service standards are defined in the PPP contract and measured by key performance indicators.

Two sets of service level standards can be distinguished:

- Service levels that apply in normal circumstances. These include the occurrence of climate-related weather events that fall outside the definition of force majeure. As a result of climate change, these events may be become quite severe, but are no longer regarded as exceptional.
- Service levels that apply in exceptional circumstances, including severe climate-related weather events that fall within the definition of force majeure. These service requirements relate to road availability, emergency response and recovery times after the occurrence of the event.

4.1 Service levels that apply in normal circumstances

Service levels that apply in normal circumstances remain applicable when climate-related weather events occur that are considered "normal", i.e., don't fall within the definition of a force majeure event. Key performance indicators for the availability and condition of roads are well known.[15] No additional climate-related indicators are needed.

Climate change may, however, have a significant impact on the efforts needed to achieve the service level standard. The contractor must take this into account when preparing the maintenance plan and in the estimation of maintenance costs. However, the service level standards themselves remain the same. The same is true for the performance measurement and monitoring system and the application of penalties in case of performance shortcomings.

[15] See for instance the *Sample Specifications for Output and Performance Based Road Contracts* issued by the World Bank. The latest edition was published in July 2023 (https://www.worldbank.org/en/projects-operations/products-and-services/brief/procurement-new-framework#SPD)

Example of road performance indicators[16]

The table below presents a sample of road performance parameters for a selection of performance areas. The indicators are the same as for a project without climate risks, but climate risks may have an impact on the road conditions and on the efforts needed to attain the performance standards.

Performance Objective	Example Indicators	Relevant Hazards
Roughness of the road surface	• Cracks of specific dimensions: *number per unit area of road* • Potholes: *number per unit area*	• (Urban, river, coastal) flooding • Snowfall/hail • Excessive heat • Ice melt / permafrost thaw • Landslides
Percentage of road closed to traffic	• Road inundated, covered by snow, or covered by debris: *percentage of roadway that is affected, as a function of the intensity of the climate-related phenomenon and the criticality of affected road sections, out of the full network or the PPP project*	All hazards
Maintenance of assets to meet specific performance standards	• Periodic condition assessments: *number/year* • Minimum asset condition score above a minimum threshold: score depends on asset type e.g., for pavement the International Roughness Index (m/km) may be used for the ride quality • Frequency of preventive maintenance actions: *number*	All hazards
Visibility/operability of traffic signs	• Distance from which signs are clearly visible: *meters* • Power/IT failures affecting digital signs: *number/event*	• Extreme rain/fog • Dust storms

4.2 Service levels that apply in exceptional circumstances

When climate-related extreme weather events occur that qualify as force majeure, the performance requirements applicable in normal circumstances are suspended for the duration of the event and its aftermath. The suspension of the standard performance requirements is not unlimited, however: the contractor must restore the availability and the full functionality of the affected road section within a maximum timeframe. In addition, the contractor is often required to participate in the emergency response, including providing information to drivers, clearing access for emergency vehicles.

For this purpose, the PPP contract defines minimum performance requirements with respect to emergency response efforts and resources, and recovery times. In general, such requirements are standard in PPP contracts. Hence, no additional climate-related requirements are needed. However, the

[16] World Bank Group (2023), *Climate Toolkits for Infrastructure PPPs – Road Sector*, table 4.2, p. 83

growing frequency and severity of climate-related natural disasters as a result of climate change increases their importance.

Example of response and recovery performance indicators[17]

The table below presents a sample of response and recovery performance indicators for roads. The indicators are the same as for a project without climate risks, but climate risks increase their relevance and importance.

KPI /Target	Example Indicators	Relevant Hazards
Functional recovery time with respect to the intensity of the event and the criticality of the road section	• Time required to reach a certain percentage of road capacity: *days* • Time required to reach 100 percent capacity: *days*	All acute hazards
Road safety	• Accidents due to climate hazards: *number*	All hazards
Availability of emergency resources	• Emergency water supply points for firefighting: *number per km* • Pumping stations: *number per km* • Fleet and maintenance plan of emergency vehicles: *number of emergency vehicles per km, frequency of maintenance activities*	• Fire • (Urban, river, coastal) flooding • Snowfall/hail • Landslides • Tornadoes/twisters/ cyclones
Emergency response time	• Time elapsed between a predicted event and a warning announcement to drivers: *minutes* • Time elapsed between a climate-related warning and the completion of all relevant emergency response procedures: *minutes*	• Fire • (Urban, river, coastal) flooding • Snowfall/hail • Tornadoes/twisters/ cyclones
Response time of emergency vehicles	• Time to access affected area: *minutes* • Time required for first aid to arrive: *minutes*	All hazards
Time to clear road	• Time required to de-ice road surface in case of extreme cold: *minutes/km* • Time required to clean road surface of debris, rockfalls, material transported by flood water, etc.: *hours (counting from the moment the road closed to traffic)*	• Snowfall/hail • Dust storms • Landslides • Tornadoes/twisters/ cyclones
Time to resume construction	• Time to resume a certain percentage of operability of construction sites following disruptive climate events as a function of their intensity: *days*	• (Urban, river, coastal) flooding • Landslide • Tornadoes/twisters/ cyclones

KPI /Target	Example Indicators	Relevant Hazards

[17] World Bank Group (2023), *Climate Toolkits for Infrastructure PPPs – Road Sector*, table 4.2, p. 83-84.

Increased preparedness for climate events	• Frequency of emergency drills: *number of evacuation/emergency response exercises per year* • Existence of procedures for post-event assessments: *yes/no*	All acute hazards
User satisfaction	• Complaints received (after climate-related events): *number/event* • Canceled or affected bus services (due to climate events): *number*	All hazards

Guidelines on service standards performance metrics and targets

No significant change should be made to performance indicators that are used for road condition and operations. The metrics to measure performance remain the same. What changes is the requirement that this performance is expected to be met when foreseeable and avoidable climate risk events occur (i.e., weather events outside the definition of force majeure).

Likewise, response and recovery performance indicators in case of an exceptional climate-related natural disaster (within the definition of force majeure) are already standard in PPP contracts and do not have to change. Climate change will, however, increase the relevance and importance of the requirements.

To summarize: climate change has no significant consequences for service standards performance metrics and targets. However, climate change may increase the resources needed to attain these targets. The contractor must take this into account when preparing maintenance and emergency preparedness and response plans.

5. CLIMATE-RESILIENCE BEST-PRACTICE IN THE OPERATIONS AND MAINTENANCE PHASE

Introduction to issue

In the operational phase the project objectives and the benefits of the use PPP must be effectively achieved. This does not happen automatically but requires an active contract management.

The contract management tasks, methods and procedures are not materially changed by climate risks. The key difference is that contract management takes place in an evolving environment because of climate change. This has consequences for:

- The assessment of force majeure events.
- The identification of the need for additional climate resilience measures and the preparation of contract variations to implement them.
- The importance of emergency preparedness and response plans; and the need for periodical tests and updates of these plans.

Assessment of force majeure events

Because of climate change the frequency of extreme weather events increases. As a result, some extreme weather events become "normal" and no longer qualify as a force majeure event. When the contractor claims relief or compensation on the ground of a climate-related extreme weather event, the contract management must check whether the criteria for force majeure have been met. The mere fact that there is damage is not sufficient evidence. In general, the contract management team will have to consult meteorological data to verify that the weather event met the severity criteria specified in the definition of force majeure in the PPP contract.

Climate change may also lead to climate risks becoming uninsurable because they become too frequent or too severe. PPP contracts prescribe a procedure for the assessment of uninsurable risks. Generally, the parties must negotiate a mutually satisfactory solution for managing the risk, failing which the contracting authority assumes the risk as insurer of last resort. In the analysis of potential solutions, the implementation of additional climate resilience measures must be examined. Such measures may either restore the insurability of the climate risks or reduce costs and losses for the contracting authority (as insurer of last resort) when a risk event occurs.

Periodic update of climate resilience needs

The climate resilience measures implemented in the project construction phase at the start of the PPP contract may not be sufficient for the entire term of the PPP contract, for several reasons.

- The rate of climate change is uncertain. A faster increase of the intensity or frequency of climate risks than expected at the time of the signature of the PPP contract cannot be excluded. Therefore, during the PPP contract term the adaptation requirements may turn out to be greater than initially planned.
- Even when the evolution of climate change is predictable and known, it can be cost-efficient to implement the climate resilience measures in phases in function of the growth of climate risks.

The contract management team must undertake a periodic evaluation of the climate resilience measures implemented in the project and investigate the costs and benefits of additional measures. If additional measures prove to be beneficial, a contract variation proposal must be prepared. The frequency of the updates depends on the rate of climate change. One specific example of a trigger for additional measures was mentioned above: climate risks becoming uninsurable.

Climate change is therefore expected to increase the need for contract variations, and also extend the scope and level of required expertise. If the required climate change expertise is not present within the contracting authority, external consultants must be hired. Alternatively, if the contractor agrees, an

independent engineer can be appointed for the purpose. A third option is to stipulate in the PPP contract that the contractor must periodically prepare an update climate resilience plan.[18] In that case the contractor must possess (or hire) the necessary climate change expertise.

Test and update of emergency preparedness and response plans

PPP contracts for projects in regions prone to natural disasters generally include an emergency preparedness and response plan. This plan prescribes the obligations of the contractor immediately after the occurrence of the disaster (information to drivers, assistance to rescue services, clearance of road from debris and floodwater, among others) and in the recovery path (aimed at restoring full functionality within a given timeframe). Climate change increases the emergency preparedness and response plans and will make them relevant in ever more areas.

Given the importance of these plans, the contract management team must conduct periodical virtual and life tests with the contractor (at least for the emergency part).

In addition, the plans must be periodically updated in function of realized and expected climate change. This task is best assigned to the contractor through a regular update requirement in the PPP contract. The reason is that the original emergency preparedness and response plan is generally prepared by the contractor (draft in the technical proposal and further elaborated in the beginning of the PPP contract term). The contract management team must evaluate and approve the updated plans.

Guidelines on climate resilience in the operations and maintenance phase

To ensure the continued integration of climate resilience in the operations and maintenance phase of the PPP project, the contract management team must fulfil the following tasks:

- Careful examination of contractor claims that a force majeure event has occurred (to distinguish real cases of force majeure from climate-related extreme weather events that have become "normal" because of climate change).
- Periodic study of the need for additional climate resilience measures (and preparation of contract variation proposals to implement any additional measures that turn out to be desirable).
- Periodic update of emergency preparedness and response plans (generally carried out by the contractor, and assessed and approved by the contract management team).

To be able to fulfil these tasks the contract management team must possess sufficient climate change expertise (either internal or outsourced).

[18] Suggested in Inter-American Development Bank (2020), *Climate Resilient Public Private Partnerships: A Toolkit for Decision Makers*, p. 114.

6. SELECTED RESSOURCES ON CLIMATE RESILIENCE IN ROAD INFRASTRUCTURE PROJECTS

Global Center on Adaptation (2025), *Climate-Resilient Infrastructure Officer Handbook*

https://gca.org/knowledge-module/

Tools and knowledge for practitioners to integrate resilience in the PPP project cycle

Inter-American Development Bank (2020), *Climate Resilient Public Private Partnerships: A Toolkit for Decision Makers*

https://publications.iadb.org/en/climate-resilient-public-private-partnerships-a-toolkit-for-decision-makers

Instruments to address climate change issues in the context of infrastructure projects

World Bank Group, *Guidance on PPP Contractual Provisions*, 2019 edition

https://ppp.worldbank.org/public-private-partnership/library/guidance-ppp-contractual-provisions-2019

Guidance and example drafting in relation to a number of core PPP contractual clauses

Contains a chapter with a discussion of contractual issues related to climate change

World Bank Group (2018), *Incorporating Climate Risk in PBC - Contracting Recommendations*

https://ppp.worldbank.org/public-private-partnership/library/incorporating-climate-risk-pbc-contracting-recommendations-task-5-report

Guidance on the integration of climate change in PBCs performance-based contracting (PBC) and Output and Performance – based Roadway Contracts (OPRC). Most of the guidance also applies to PPPs, which are also a type of performance-based contract.

World Bank Group (2023), *Climate Toolkits for Infrastructure PPPs*

https://www.ppiaf.org/feature/new-climate-toolkits-infrastructure-ppps

Set of six guidelines with practical tools to integrate climate mitigation and adaptation into PPP advisory work and project structuring:

- Umbrella Toolkit
- Water Production and Treatment Toolkit
- Digital/ICT Toolkit
- Hydropower Toolkit
- Renewable Energy Toolkit
- Roads Toolkit