《基建及建築工程碳管理研究報告》

RESEARCH REPORT ON CARBON MANAGEMENT FOR INFRASTRUCTURE AND BUILDING WORKS OF HONG KONG

(Abridged Version 1.0)

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HKIE Task Force on Engineering Excellence and Standardisation in Greater Bay Area

1. INTRODUCTION

Hong Kong and the Greater Bay Area (GBA) are at a pivotal juncture in their development, facing the dual challenge of sustaining economic growth while meeting ambitious climate goals. The Hong Kong Climate Action Plan 2050 (CAP2050) mentions that Hong Kong strives to achieve carbon neutrality before 2050, with an interim target to halve carbon emissions by 2035. This commitment aligns with both China's national "3060" dual carbon goals and the GBA's accelerating regional decarbonisation agenda, exemplified by initiatives such as the recent "Guiding Opinions on Carrying out the Construction of Zero-carbon Plants."

International climate frameworks such as PAS 2080, the ISO 14064, the ISO 14067 and the EN15804 standards, along with green-finance taxonomies emerging in both the mainland and the European Union, now require verifiable emission data and transparent reporting. The Greater Bay Area's focus on connectivity and innovation further highlights the value of shared data platforms and aligned carbon methodologies. The public and private sector of Hong Kong should transition from fragmented assessments to an interoperable, system-based approach.

This report therefore examines how carbon appraisal and management can be systematically embedded into governance processes and institutional culture. It outlines what needs to change, from governance mechanisms to data infrastructure, and how to achieve it through structured actions at both the project and organisational levels. These recommendations draw on lessons from ongoing pilot studies and stakeholder consultation within Hong Kong and the GBA, framing practical steps the public and private sector could implement.

The report is organised into four main parts:

- OVERVIEW: to describe the context, policy drivers, and rationale for integrating carbon management into GBA's and Hong Kong's infrastructure and building works portfolio;
- LOCAL AND OVERSEAS REVIEW: to summarise current best practices overseas, identify major gaps in Hong Kong, and highlight leading examples from international counterparts;
- KEY ASKS AND RECOMMENDATIONS: to provide recommendations in project and organisation level; and
- LOOKING AHEAD: to outline actions organizations should take in the future.

By positioning carbon management as both a policy imperative and an opportunity for innovation, this report aims to support project owners, practitioners, contractors, industry partners, and financial institutions in building a transparent and data-driven foundation for Hong Kong's next generation of infrastructure. The integration of these systems will not only reduce emissions but also enhance supply-chain competitiveness, and establish Hong Kong as a regional exemplar of climate-aligned governance.

2. OVERVIEW

This section gives an overview of the policy frameworks that shape carbon management in Hong Kong and Chinese Mainland. It first introduces Hong Kong's Climate Action Plan 2050, which sets the city's pathway toward striving to achieve carbon neutrality before 2050 and outlines sectoral

strategies for decarbonising its built environment and transport systems. It then examines China's "3060" dual-carbon goals, peaking emissions before 2030 and reaching carbon neutrality by 2060, which provide the national foundation for long-term climate action across the region. Together, these frameworks establish a clear regional vision for low-carbon development and form the strategic basis for integrating carbon management into Hong Kong's infrastructure and building works, ensuring policy coherence with the GBA's collective progress toward a climate-neutral future

2.1. Chinese Mainland's Carbon Neutrality Target – The 2060 Vision

In September 2020, China announced its national "3060 Goals" – to reach peak carbon emissions before 2030 and achieve carbon neutrality by 2060. This long-term pledge forms the foundation of China's overall energy and climate strategy and establishes a clear roadmap for industrial, urban, and infrastructure transformation. The Central Government has since introduced multiple sectoral initiatives under this umbrella, collectively aimed at restructuring the economy toward green and high-efficiency development.

In parallel, the strategic direction recently set out in China's 15th Five Year Plan (2026-2030) further reinforces the transition toward system level carbon management and green development across infrastructure and the built environment. The Plan emphasises the need to accelerate the construction of a "new energy system", promote the shift toward green and low carbon production and consumption, and progressively establish a "dual control of carbon" framework, integrating both carbon emission intensity and total emissions into economic and infrastructure planning.

Importantly, the Plan signals a continued shift from energy focused management toward carbon centred governance, supported by mechanisms such as project level carbon assessment, product carbon foot printing, and system wide data and certification frameworks. It also sets indicative targets, including a reduction in carbon intensity over the planning period and an increasing share of non-fossil energy, while reinforcing the role of clean energy, electrification, and digital systems in enabling decarbonisation.

2.2. Hong Kong Climate Action Plan 2050

In 2021, the Hong Kong SAR Government released the Climate Action Plan 2050 (CAP2050), a comprehensive roadmap striving to achieve carbon neutrality before 2050. The plan sets an interim target of halving total carbon emissions by 2035 compared to 2005 levels. It aligns with the global climate agenda under the Paris Agreement and China's national "3060" dual carbon goals.

CAP2050 is structured around four major decarbonisation strategies:

1. Net-zero Electricity Generation
2. Energy Saving and Green Buildings
3. Green Transport
4. Waste Reduction and Waste-to-Energy

Each strategy is supported by sector-specific targets and policy instruments. For infrastructure and building works and infrastructure, the most immediate and material impact lies in reducing operational energy demand and enabling the transition to clean energy and mobility systems.

CAP2050 provides a clear strategic direction for decarbonisation. However, its emphasis remains on operational energy, with limited attention to embodied carbon or whole-lifecycle emissions given most construction materials are imported from areas outside Hong Kong. For infrastructure and building works, this presents both a challenge and an opportunity. While operational energy efficiency is a critical starting point, the next frontier lies in addressing whole-life carbon – from material extraction and construction to operation, maintenance, and end-of-life.

3. LOCAL AND OVERSEAS REVIEW

As Hong Kong and Chinese Mainland deepen their commitments to carbon neutrality, the need for robust, interoperable carbon management standards becomes increasingly urgent. Infrastructure and building works, which shape the long-term emissions trajectory of cities and regions, require consistent methodologies for quantifying, reporting, and reducing carbon emissions across the entire infrastructure lifecycle. This section examines the current state of carbon management standards in Hong Kong, the GBA/Chinese Mainland, and leading international jurisdictions. It identifies areas of alignment, divergence, and opportunity, with a particular focus on how these frameworks support or constrain the mainstreaming of carbon appraisal in public infrastructure delivery. Some references included in this section provide broader contextual background on system-level carbon management across sectors. While not all are directly related to the built environment sector and construction-stage emissions, they are included to reflect the increasingly interconnected nature of carbon management across value chains and industries.

3.1. Regulations and Standards – Hong Kong

Hong Kong's carbon management is anchored in a series of policy and reporting instruments that reflect a strong commitment to climate goals but fall short in systemic and institutional approach of managing carbon. The table below summarises Hong Kong's existing carbon management instruments, highlighting their scope and key gaps.

Name	Scope of Application	Key Features
Climate Action Plan 2050	Economy-wide	Economy-wide decarbonisation targets (Net-zero by 2050; 50% reduction by 2035); long-term policy roadmap; sectoral transition strategies
Practical Guide on Carbon Audit and Management	9 sector-specific building types (offices, schools, sports centres, swimming pools, public markets, healthcare facilities, fire stations, postal facilities and community halls) *	Carbon audit methodology; sector-specific guidance; practical emission reduction measures
HKGBC Climate Change Framework for the Built Environment	Buildings & built-environment	Standardised definitions; whole-life carbon framework (embodied & operational carbon); climate risk and resilience guidance; certification pathways
Guidelines to Account for and Report on GHG Emissions and Removals for Buildings	Buildings	Standardised GHG accounting methodology; Scope 1-3 coverage; alignment with ISO 14064-1
CIC Carbon Assessment Tool (CAT)	Building and infrastructure projects	Embodied-carbon quantification for A1-A5; local emission factors
CIC Green Product Certification	Construction-related products and materials *	Product-level environmental certification; multi-criteria performance labelling; integration with BEAM Plus
Environmental Reporting for the Government Bureaux and Departments	Organizations - Government departments	Organisation-level carbon disclosure framework; mandatory Scope 1-3 reporting; government accountability mechanism

* Not directly related to construction stage carbon emission

3.2. Regulations and Standards – Chinese Mainland

Compared with Hong Kong's largely policy-led and voluntary approach, Chinese Mainland has developed a more technically prescriptive and multi-tiered carbon management system, spanning national standards, provincial implementation mechanisms, and most recently precinct- and asset-level guidance. Together, these instruments reflect a clear transition from enterprise-level reporting toward systematic, lifecycle-based carbon governance covering industrial parks, factories, infrastructure precincts, and supply chains, with direct implications for the Greater Bay Area (GBA).

Name	Scope of Application	Key Features
Implementation Plan on Establishing a Carbon Footprint Management System 关于建立碳足迹管理体系的实施方案 (2024)	Economy-wide *	National carbon management framework; system-level roadmap; integration of data infrastructure and certification systems
Measures for the Administration of Carbon Emissions Trading (Trial) 碳排放权交易管理办法(2020)	Economy-wide *	Regulatory framework for emission trading system (ETS) and mechanism; MRV system and quota allocation; market-based emission control framework
Carbon Management Systems – Requirements 碳管理体系要求 T/CCAA 39-2022	Economy-wide	Carbon management certification framework; system requirements definition; third-party verification and auditing
Notice on Carrying out the Construction of Zero-carbon Parks 关于开展零碳园区建设的通知 (2025)	Precinct *	Precinct-level decarbonisation trials; system-scale zero-carbon management; integration of energy, industry and infrastructure
Guiding Opinions on Carrying Out the Construction of Zero-Carbon Plants 关于开展零碳工厂建设工作的指导意见 (2026)	Industrial Plants *	Industrial decarbonisation trials; Scope 1 and 2 baseline requirements; progression toward supply-chain and product carbon management
Standard for Building Carbon Emission Calculation 建筑碳排放计算标准 GB/T 51366-2019	Buildings	Lifecycle carbon calculation methodology; building-level application; standardised emission accounting
Standard for Building Decoration and Fit-Out Carbon Emission Calculation 建筑装饰装修工程碳排放计算标准	Buildings	Lifecycle carbon assessment methodology; Scope 1-3 coverage; detailed emission intensity calculation for fit-out works
Guideline for Building Carbon Emission Calculation 建筑碳排放计算导则 (2021)	Buildings	Local adaptation; emission factors
Carbon Emission Management System - Requirements with Guidance for Use 碳排放管理体系要求及使用指南 DB44/T1944-2016	Organizations	Organisational carbon management framework; ISO-aligned methodology; monitoring, reporting and disclosure requirements
Progress Report on The Construction of China's Product Carbon Footprint Management System 产品碳足迹管理体系建设进展报告 (2025)	Product level *	Product-level carbon disclosure system; pilot certification schemes; development of supporting databases

* Not directly related to construction stage carbon emission

3.3. Regulations and Standards – International

The table below summarises the primary characteristics of major international frameworks, highlighting their respective strengths and limitations when applied in isolation.

Name	Scope	Strengths	Key constraints if applied in isolation
PAS 2080:2023	Whole-life carbon management for buildings and infrastructure	System-level governance framework; cross-value-chain collaboration; carbon embedded in decision-making	Not a calculation methodology; relies on supporting standards and tools for quantification
ICMS 3rd Ed.	Global cost and carbon reporting for construction projects	Standardised cost-carbon reporting structure; supports benchmarking and decision-making; internationally recognised	Does not define carbon calculation methods; requires integration with other frameworks
BS EN 15978	Building lifecycle carbon assessment (LCA)	Clear modular lifecycle structure; consistent and comparable methodology; supports building-level assessment	Limited to buildings; data-intensive; focuses on environmental metrics only
BS EN 17472:2022	Lifecycle sustainability assessment of civil engineering works	Comprehensive lifecycle framework; integrates environmental, economic and social dimensions; applicable to infrastructure	Complex to apply; high data and modelling requirements; not directly applicable to buildings
ISO 14067:2018	Product-level carbon footprint *	Flexible system boundaries (e.g. cradle-to-gate) suitable for supply-chain and Scope 3 analysis; Applicable across sectors and regions	Limited to climate change only, excluding other environmental, economic, or social impacts; Does not address asset- or project-level functional equivalence. Cannot by itself support comparison of construction or infrastructure design solutions
EN 15804	Environmental Product Declarations for construction products	Standardised life-cycle modules (A-D) enabling aggregation at building level Mandatory third-party verification, suitable for procurement and regulatory use Supports comparability of construction materials and components	Focused on product level, not whole projects or systems; Limited ability to compare alternative design solutions on a functional basis; Requires higher-level frameworks to inform decision-making

* Not directly related to construction stage carbon emission

3.4. Examples of Initiatives and Projects

The global transition toward low-carbon infrastructure is well underway. Across jurisdictions, public agencies, professional institutions, and major asset owners are applying carbon management frameworks and related standards in real projects, building shared databases, and moving embodied carbon from voluntary reporting toward regulated requirements. These developments offer concrete

reference points for Hong Kong and the GBA for how to mainstream carbon appraisal in infrastructure and building works. Examples include:

- SE2050: Professional-led Commitments on Embodied Carbon
- IStructE Commitments in Practice: Embedding Climate Leadership in Structural Engineering
- The ICE Carbon Project: Building Carbon Literacy and Systemic Change
- Net Zero Highways: Decarbonising the UK Road Network
- Rail Sector Decarbonisation: Lessons from Australia and US
- PAS 2080 Adoption for Whole-life Carbon Governance – National Grid and other Infrastructure
- ICMS 3rd Edition in Practice: Global Application of Cost-Carbon Reporting
- EN 15978 in Practice: Building LCA for Circular and Low-Impact Design
- EN 17472 in Practice: Carbon Accounting for Civil Engineering Works
- ISO 14060: Net Zero Aligned Organisations (under development)
- CIBSE TM65: Embodied carbon in building services
- RICS Whole Life Carbon Assessment for the Built Environment
- UN Net Zero Carbon Buildings Standard
- Pilots in Hong Kong (Building)
    - Carbon Neutrality Strategic Framework to Address Upfront Embodied Carbon (Architectural Services Department)
    - Low Carbon Transition and Embodied Carbon Initiatives (Hong Kong Housing Society)
- Pilots in Hong Kong (Infrastructure) – Carbon Management Platform and Performance Deep-Dive for Major Construction Activities (Civil Engineering and Development Department)

3.5. Summary of Experiences and Implications

While Sections 3.2 to 3.4 list implications arising from individual standards, guidelines and initiatives, this section consolidates those findings into system level lessons and implications for Hong Kong infrastructure and building works as a whole.

3.5.1. Experiences

The comparative review across GBA/Chinese Mainland (Section 3.2), international initiatives and sector examples (Section 3.3) points to a common trend: carbon management is shifting (i) from a single stage (e.g. operational energy) to whole-life emissions, (ii) from voluntary practice to structured governance and disclosure for manufacturing industry, and (iii) from siloed studies to value-chain and portfolio-level collaboration. For Hong Kong, the key takeaway is not simply to "do more reporting", but to build a system that makes carbon a repeatable decision metric for infrastructure and building works – comparable across projects, measurable and audible over time. Here is a summary of key experiences:

1. Move from carbon reporting to carbon management

Carbon is treated as a management input that shapes planning, optioneering, procurement, and delivery – not a retrospective sustainability appendix. The differentiator is whether carbon outcomes are embedded into governance and delivery workflows (targets, accountability, decision gates), rather than produced as standalone studies. For Hong Kong infrastructure and building works, this implies shifting from ad hoc or individual project assessments, to a programme level approach where carbon requirements are integrated into business cases, design approvals, and tender evaluation criteria.

2. Boundary setting and fit-for-purpose metrics are the foundation for comparability and scale

Mature systems start with clear and consistent boundaries, then expand coverage over time. Chinese Mainland's latest direction reinforces this by making operational boundaries clear (Scope 1 and 2 as baseline expectations) while encouraging progressive inclusion of supply-chain impacts. International frameworks similarly emphasise whole-life thinking and "control vs influence" boundaries. For Hong Kong infrastructure and building works, this implies adopting a common boundary "rulebook" across organizations and project types, so that carbon performance can be measured and compared on a fair and repeatable basis. Without both consistent boundaries, performance evaluation and cross-project comparison will remain limited, and data cannot be scaled or relied upon.

3. Lifecycle carbon to extend beyond buildings to infrastructure and precincts

International practice increasingly applies lifecycle carbon methodologies to infrastructure systems (roads, rail, utilities) and precinct scale development, supported by sector roadmaps and standardised assessment approaches. The implication is that infrastructure emissions cannot be treated as secondary or excluded simply because they are delivered by multiple parties. For Hong Kong infrastructure and building works, this implies expanding carbon appraisal from building centric tools toward consistent whole life carbon application across other project types, with comparable reporting formats that support portfolio oversight.

4. Embodied carbon is a management progression through procurement and specifications

Across both GBA and international experience, supply chain emissions are increasingly addressed not by immediately mandating exhaustive inventories, but by using procurement, specifications, and product level disclosure to influence upstream choices (materials, logistics, suppliers) and lock in low carbon pathways. For Hong Kong infrastructure and building works, this implies treating Scope 3 as a phased management agenda: start with hotspot categories most influenced by procurement (materials and construction supply chains), require product transparency where feasible, and progressively strengthen requirements as data quality and market readiness improve.

5. Data, digitalisation and transparency are what makes carbon governance repeatable

Leading jurisdictions invest in shared data structures, consistent emission factors, and digital workflows that enable carbon estimation, tracking, and performance evaluation at scale. Without this, carbon assessments remain one off exercises with limited comparability. For Hong Kong infrastructure and building works, this implies moving toward a city level carbon database collected from individual projects, with standardised reporting fields and quality control, so that carbon intelligence accumulates over time and informs future decisions.

6. Phase implementation: build capability first, then tighten requirements

The most robust systems avoid a single "one-off" shift. Instead, they sequence implementation: establish consistent boundaries and governance, pilot data capture and assessment, then gradually strengthen procurement and disclosure requirements. This reduces risk, improves data credibility,

and builds industry capability. For Hong Kong infrastructure and building works, this implies adopting a progressive phased pathway that starts with what can be standardised now (Scope 1-2 boundaries, core datasets, reporting templates), while using pilots to mature Scope 3 approaches before formalising them into broader requirements.

3.5.2. Concluding implications for Hong Kong and the GBA

Hong Kong's infrastructure and building works portfolio has unique leverage: its procurement scale, standard-setting role, and ability to convene organizations, companies and supply chains give it the capacity to move the market – if carbon is embedded as a governance requirement rather than an optional reporting requirement. Aligning with international direction and best practice requires adopting the common "system ingredients": clear boundaries, standard methods, transparent data, and procurement-driven improvement. This is the basis on which Hong Kong can mainstream carbon appraisal, institutionalize carbon management, maintain GBA interoperability, and protect long-term investment value.

4. KEY ASKS AND RECOMMENDATIONS

The recommendations in this section are framed to align with emerging policy directions, technical standards, and implementation approaches, as well as international best practice reviewed in Sections 2 and 3. For related organizations, companies and project owners, these recommendations should be understood as expectations of leadership and alignment, exercised in accordance with their respective governance, regulatory, and commercial arrangements. In this sense, the actions proposed below set out how Hong Kong can strengthen carbon management within its own institutional remit while maintaining long term interoperability, comparability, and credibility within the wider GBA context.

Theme	Project Level	Organisation Level
Carbon Appraisal	**"Assess carbon early, assess carbon always"** Embed carbon appraisal as one of the decision inputs from early planning and optioneering through construction, with proportionate carbon tracking during delivery and operation.	**"Make carbon a strategy, not a report"** Embed carbon management into corporate strategy rather than a reporting exercise, with oversight from the senior management
Governance & Management	**"Follow one rulebook"** Apply common carbon boundaries, methods, and tools across projects.	**"Institutionalize the system"** Establish a carbon governance framework with clear ownership, mechanisms and cross-project accountability.
Data & Performance Evaluation	**"Collect right data for analysis"** Collect consistent carbon data at planning, design and construction stages, structured for reuse, performance evaluation and referencing across projects.	**"Turn project data into evaluations"** Aggregate project-level carbon data to establish portfolio-wide performance evaluations, investment decisions and performance trends over time.
Digital	**"Digital by default"** Adopt digital tools to estimate, track, and visualize carbon performance at project level.	**"One platform, many projects"** Establish a common digital carbon platform enabling portfolio-level analysis, cross-department interoperability, and future GBA alignment.

5. LOOKING AHEAD

The engineering and construction sector now has an opportunity to move beyond fragmented assessments and pilot initiatives, and to establish a coherent carbon management system that embeds governance, data, and digital capability into everyday infrastructure and building works delivery. Acting decisively at this stage will reinforce policy credibility, improve investment readiness, and position Hong Kong as a data driven and interoperable partner within the wider Greater Bay Area (GBA).

Build the foundations first: governance and accountability

The first priority is to institutionalise governance and accountability for carbon management at organizational level, as well as project level across infrastructure and building works, which includes defining common project boundaries, harmonising calculation approaches, and overseeing consistent implementation across project types.

Establish credible data, focused on design and construction

The second priority is to develop a city-wide carbon data that supports learning, comparability, and evidence-based decision making. One key consideration is an interoperable digital platform that captures design stage optioneering data and construction stage performance data, and aggregates information into a common database.

In the near term, this system should prioritise design and construction stages, recognising that these phases offer the greatest leverage for emission reduction and performance improvement in infrastructure and building works. Data standards should be consistent across organizations, proportionate to project scale, and structured to enable aggregation across project types. Selected sites may be equipped with digital tools – such as fuel tracking or plant metering – to improve data quality for high impact activities, supporting gradual improvement rather than exhaustive reporting from the outset.

The platform should also be designed to remain compatible with emerging GBA data frameworks, ensuring future interoperability and mutual learning, while remaining firmly within Hong Kong's institutional remit. These measures are intended to enable alignment and comparability, rather than to prescribe or duplicate regulatory arrangements outside Hong Kong's jurisdiction.

Align finance, policy and capability development

The third priority is to gradually align green finance mechanisms with verified carbon performance. Coordination between DEVB, EEB, FSTB and HKMA should ensure that carbon appraisal outputs from infrastructure and building works projects are credible inputs into green funding eligibility, sustainability linked finance, and reporting under relevant taxonomies. Pilot incentives – such as preferential financing terms or recognition mechanisms – can be used to reward projects that demonstrate measurable improvement through early-stage design choices and construction practices.

In parallel, sustained investment in capability building will be essential. For instance, structured training programmes for engineers, planners, and procurement professionals, focusing on practical carbon appraisal skills, data interpretation, and decision-making use. Partnerships with universities, professional institutions, and where appropriate GBA counterparts, can support knowledge exchange and help build a critical mass of competent practitioners across the sector and supply chain.

Consider early action to avoid lock in and loss of credibility

Looking ahead, Hong Kong's focus should be on building four interlocking foundations: effective governance, credible and reusable data, robust digital infrastructure, and policy-finance coherence. By prioritising design and construction stage carbon management now, and allowing operational

coverage to expand progressively as systems mature, Hong Kong can establish a pragmatic, future proof carbon management system.

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