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AIRPORT FUNCTIONAL CLASSIFICATION

Concepts, Systems and Methodology



Vadim Stepanov

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This publication presents an independent analytical framework for the functional classification of airports. AFCS is intended to complement, not replace, regulatory, operational, infrastructure, statistical or administrative classifications issued by ICAO, IATA, ACI, national aviation authorities or other competent organisations.

Users remain responsible for verifying operational, regulatory, safety-critical or legal information through the relevant official authorities.

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Summary

This book examines airport classification from an international and functional perspective. It begins by establishing the conceptual and practical need for airport classification and reviews the principal international, national and academic approaches used to classify airports, comparing their objectives, objects, criteria, strengths and limitations. On this basis, the book develops a conceptual framework centred on Airport Functions, the Airport Functional Profile and the distinction between Primary and Secondary Airport Functions, and introduces the Airport Functional Classification System (AFCS) as a common methodology for identifying an airport's dominant functional role. The proposed taxonomy and classification methodology are then applied empirically to a global dataset of 951 airports handling at least one million passengers in 2025, demonstrating the practical use of functional dominance and the resolution of competing functions. The final part considers applications of AFCS in comparative airport research, databases and information systems, planning and management, GIS and digital tools, its integration within the broader World Aviation Information System (WAIS), and directions for future development. Together, these elements provide a structured framework for describing, comparing and analysing airports according to the roles they perform within aviation networks, markets and territories.

Author's Preface

This book is the first publication issued within the World Aviation Information System (WAIS) publication series. It reflects the broader objective of WAIS to develop structured, comparable and internationally applicable approaches to aviation information, analysis and classification.

The subject of this first publication — airport functional classification — was selected because the role performed by an airport is fundamental to understanding its position within aviation networks, markets and territories. Existing airport classifications provide important regulatory, operational and statistical perspectives, but they do not always offer a common framework for describing what airports actually do within the aviation system. The Airport Functional Classification System (AFCS) presented in this book is intended to address this analytical dimension.

The work combines conceptual analysis, comparison of existing classification systems, development of a functional taxonomy and classification methodology, and their empirical application to airports worldwide. It is intended both as a contribution to airport research and as a practical foundation for further development of aviation data, analytical tools and information systems within WAIS.

Vadim Stepanov

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Abbreviations

AAI	Airports Authority of India
AC	Advisory Circular
ACI	Airports Council International
ADRM	Airport Development Reference Manual
AFCS	Airport Functional Classification System
AIP	Airport Improvement Program
AMG	Alternative Metropolitan Gateway
ATM	Air Traffic Management
CAAC	Civil Aviation Administration of China
CANSO	Civil Air Navigation Services Organisation
CAP	Capital Airport
CFR	Code of Federal Regulations
CGO	Cargo Airport
DGCA	Directorate General of Civil Aviation
EUROCONTROL	European Organisation for the Safety of Air Navigation
FAA	Federal Aviation Administration
GEN	General Aviation Airport
GHB	Global Hub
GIS	Geographic Information System
HEL	Heliport
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
ISL	Island Airport
MAS	Multi-Airport System
MIL	Military Airport
MoCA	Ministry of Civil Aviation
MSR	Mixed System Role
NHB	National Hub
NOP	Network Operations Plan
NPIAS	National Plan of Integrated Airport Systems
OECD	Organisation for Economic Co-operation and Development
PANS	Procedures for Air Navigation Services
PMG	Primary Metropolitan Gateway
REG	Regional Airport
REM	Remote Airport (proposed research category; not part of the current AFCS taxonomy)
Rosaviatsiya	Federal Air Transport Agency
SEA	Seaplane Base
TGW	Tourist Gateway
UDAN	Ude Desh ka Aam Naagrik (Regional Connectivity Scheme)
WAIS	World Aviation Information System

Chapter 1

Introduction

1.1 Background

Airports are essential parts of the global air transport system, but their importance is not confined to aircraft operations. They connect communities and markets, support trade and regional economies, and in some places provide infrastructure for emergency, governmental or military activity. As air transport has become more interconnected, many airports have also developed into multimodal transport nodes and major centres of economic activity [1,2].

Airports nevertheless differ greatly in what they are mainly used for. At some airports international passenger traffic is the defining activity; at others the dominant role is regional access, cargo, training, general aviation or support for public services. Several functions commonly coexist at the same airport, and their relative importance can change as markets, technology, regulation and transport demand change.

To support planning, regulation, infrastructure development and statistical reporting, numerous airport classification systems have been developed by international organisations, national aviation authorities, airport associations and researchers. These systems classify airports according to a variety of characteristics, including infrastructure, traffic volume, certification status, ownership, operational capabilities and economic indicators [3,4]. Each reflects the specific objectives of the organisation that developed it and serves particular regulatory, operational or analytical purposes.

Although these classification systems have proved effective within their intended domains, they do not provide a universally applicable description of the roles airports perform within the aviation system. Airports with similar operational profiles may therefore be assigned to different categories under different classification schemes, while airports with fundamentally different missions may be grouped together because they satisfy the same administrative or statistical criteria. Such inconsistencies complicate comparative studies, international benchmarking and the integration of aviation information originating from different regulatory environments.

The continuing digital transformation of aviation has further increased the need for classification frameworks that are internationally applicable, conceptually consistent and independent of national administrative practices. Integrated aviation databases, geographic information systems, digital twins and advanced decision-support tools require a common language capable of describing airports according to the functions they perform rather than solely according to their regulatory status, infrastructure or traffic volume.

This study reviews existing airport classification systems from a functional perspective and develops a conceptual framework for describing airport functions. Rather than replacing established regulatory or administrative classifications, the proposed framework introduces an additional analytical perspective for understanding the operational roles of airports within the global aviation system.

1.2 The Need for Functional Classification

Existing airport classification systems have been developed primarily to satisfy regulatory, operational, administrative and statistical requirements. They support airport certification, infrastructure planning, air traffic management, safety oversight, economic regulation and statistical reporting, and remain essential components of contemporary aviation governance [3,4].

Physical infrastructure, ownership, certification status and traffic volume describe important characteristics of an airport, but they do not fully describe its place in the aviation system. That place also depends on function. Airports with similar facilities and traffic levels may serve quite different markets or network roles; conversely, airports that look very different in physical terms may perform a similar transport function.

These differences matter increasingly when airport information is combined across countries. A global database may bring together records produced under different regulatory and administrative systems, where nominally similar categories do not necessarily mean the same thing. The result is practical difficulty in harmonising data and comparing airports, especially in GIS, digital aviation platforms and other information systems that depend on consistent definitions.

Functional classification approaches the problem from another direction: it asks what an airport primarily does within the aviation system. Administrative status, ownership and infrastructure remain relevant evidence, but they are not the classification target. The target is the airport's principal operational role and its contribution to the wider network.

This functional view is additional to, not a substitute for, regulatory, operational or statistical classification. Its value is that the same analytical question can be asked of airports operating under different national systems. This makes cross-country comparison easier without requiring those national systems to be standardised or replaced.

1.3 Objectives

The primary objective of this study is to establish a comprehensive conceptual framework for the functional classification of civil airports and to present a practical methodology applicable to airport analysis, information management and comparative research.

To achieve this objective, the study pursues the following objectives:

- to review the principal airport classification systems developed by international organisations, national aviation authorities and the academic community;
- to analyse the conceptual foundations, objectives, strengths and limitations of existing classification approaches;
- to identify the need for a consistent functional perspective applicable across different regulatory, geographical and operational environments;
- to define the concept of airport functional types as an analytical framework for describing the operational roles of airports;
- to develop a methodology for assigning functional types based on observable operational characteristics and objective classification criteria;
- to demonstrate how a functional framework complements existing regulatory, administrative and statistical classification systems;
- to demonstrate the application of the proposed framework to airport information management, comparative analysis, planning, research and decision-support systems.

The framework developed in this study is intended to provide both a theoretical foundation and a practical methodology for describing airport functions in a consistent, internationally applicable and analytically robust manner. Developed within the framework of the World Aviation Information System (WAIS), it is intended for application to airports worldwide regardless of national regulatory systems or organisational structures.

1.4 Scope

This study is concerned with the functional classification of civil airports in an international setting. It treats the airport as an operating entity whose role is defined by the network, market and territory it serves.

The review covers classification systems used by international organisations, national aviation authorities and academic researchers. Their objectives and underlying concepts are examined because they provide the evidence from which the functional framework is developed.

The proposed framework is applicable to airports of all sizes and operational profiles, including international, regional, local and specialised civil airports. It has been designed to operate independently of national legislation, ownership structures, certification schemes and administrative arrangements, enabling airports from different countries to be described using a common functional language.

The scope of this study is limited to the classification of airports according to the functions they perform within the aviation system. It does not address airport design standards, airspace management, airport certification procedures, economic regulation, financial performance or detailed operational planning except where these aspects contribute directly to understanding airport functions.

Although examples may include airports supporting military, governmental or emergency operations, the principal emphasis remains on civil aviation. Military air bases, heliports, seaplane bases and other specialised aviation facilities are discussed only where they provide relevant context or illustrate functional relationships.

1.5 Structure of the Publication

This publication is organised into eight chapters that progressively develop the theoretical foundations, analytical framework, classification methodology and practical application of airport functional classification.

Chapter 1 introduces the background, objectives and scope of the study and explains the rationale for adopting a functional perspective in airport classification.

Chapter 2 reviews the principal airport classification systems developed by international organisations, national aviation authorities and the academic community. It examines their objectives, classification criteria and practical applications.

Chapter 3 presents a comparative analysis of the classification systems reviewed in the previous chapter. Their conceptual foundations, strengths and limitations are examined to identify common principles, significant differences and the remaining research gap.

Chapter 4 develops the conceptual framework for functional airport classification. It defines the concept of airport function, distinguishes primary and secondary functions, addresses multifunctional airports and establishes the principles and criteria underlying the functional approach.

Chapter 5 presents the functional taxonomy of airports, including the principal functional types, reserved categories and the overall structure of the Airport Functional Classification System (AFCS) taxonomy.

Chapter 6 describes the classification methodology, including the classification principle, functional evidence, determination of the primary airport function, resolution of competing functions and classification output.

Chapter 7 provides empirical validation and application of AFCS using the study dataset. It examines the distribution of functional airport types, selected classification cases, validation results, observations, scope and limitations.

Chapter 8 considers applications and future development of AFCS, including comparative airport analysis, research, databases and information systems, airport planning and management, GIS and digital applications, integration with WAIS, and classification stability and future development.

The publication concludes with a synthesis of the principal findings and a References section.

Chapter 2

Existing Airport Classification Systems

2.1 Introduction

Airport classification has evolved alongside the development of civil aviation. As air transport systems expanded in scale, complexity and operational diversity, governments, international organisations, airport operators and researchers developed a variety of classification frameworks to support infrastructure planning, airport certification, operational management, economic regulation, statistical reporting and strategic decision-making [3,4].

Although these frameworks differ considerably in their objectives, scope and classification criteria, they share a common purpose: to organise airports into meaningful categories that facilitate planning, regulation and analysis. Each framework reflects the institutional responsibilities of the organisation that developed it and is therefore optimised for specific technical, operational, administrative or economic objectives rather than for universal application.

International airport classification frameworks establish common standards, terminology and technical principles applicable across national boundaries. Their principal objective is to promote the safe, secure and efficient development of international civil aviation through harmonised regulatory requirements and technical guidance [3–5]. National airport classification systems, by comparison, address country-specific legislative, administrative and transport policy requirements while reflecting the geographical, economic and operational characteristics of individual States.

Academic approaches provide a third perspective. Rather than supporting regulation or airport administration, they analyse airports from engineering, operational, economic and transport-planning viewpoints. Consequently, academic classifications frequently employ criteria that differ from those adopted by aviation authorities and international organisations [1,2].

A single airport may therefore belong simultaneously to several independent classification systems. The same facility may possess an ICAO Aerodrome Reference Code, belong to a national administrative category, function as an airline hub within a commercial network and be classified differently in academic literature. These classifications are complementary rather than contradictory because each describes a different aspect of airport infrastructure, operations or organisational role.

The coexistence of multiple classification systems illustrates both the complexity of contemporary aviation and the absence of a universally accepted framework for describing airports according to the functions they perform. Existing systems predominantly classify airports according to infrastructure characteristics, aircraft types, passenger traffic, ownership, certification status or administrative responsibilities, whereas comparatively few explicitly consider airport functions as the principal classification criterion.

This chapter reviews the principal airport classification frameworks employed by international organisations, national aviation authorities and the academic community. Collectively, these approaches establish the factual foundation for the comparative analysis presented in Chapter 3 and for the development of the functional airport classification proposed in this monograph.

International Airport Classification Frameworks

International airport classification frameworks provide the common technical and regulatory foundation upon which most national airport classification systems have evolved. Although these frameworks differ in institutional responsibilities and operational focus, they establish internationally recognised principles that promote interoperability, standardisation and the safe development of global civil aviation.

Taken together, the approaches developed by ICAO, ACI, IATA and EUROCONTROL represent four complementary perspectives on airport classification: regulatory, managerial, commercial and network-oriented. Examining these perspectives is essential for understanding both the strengths and the limitations of existing international approaches.

2.2 ICAO Classification Framework

The regulatory foundation of modern international civil aviation is provided by the International Civil Aviation Organization (ICAO). Established under the Convention on International Civil Aviation (Chicago Convention), ICAO develops the Standards and Recommended Practices that form the basis of airport legislation, technical standards and operational regulations adopted by its Member States [3–5].

Unlike many national aviation authorities, ICAO does not classify airports according to their commercial significance, ownership or administrative status. Instead, its framework is concerned with the technical and operational characteristics required to ensure the safe and efficient operation of aircraft. Accordingly, the primary object of classification is the aerodrome as an aviation infrastructure facility.

The ICAO framework is principally defined by Annex 14 — Aerodromes, Volume I: Aerodrome Design and Operations, together with the associated Procedures for Air Navigation Services — Aerodromes (PANS-Aerodromes, Doc 9981) [3,4]. These documents establish internationally harmonised requirements governing airport design, certification, obstacle limitation, visual aids, pavement characteristics, rescue and firefighting services, and aerodrome operations.

A central component of the framework is the Aerodrome Reference Code, which establishes airport design requirements according to the operational characteristics of the aircraft intended to use the aerodrome. The code combines a numerical element, determined principally by runway reference length, with an alphabetical element based on aircraft wingspan and outer main gear wheel span [3]. Its purpose is to ensure compatibility between airport infrastructure and aircraft rather than to distinguish airports according to their operational role.

The framework also establishes internationally harmonised requirements for airport certification, operational safety, aerodrome management and infrastructure maintenance. Through these provisions, ICAO provides a common technical language that enables States to develop compatible airport regulations while accommodating national legislative requirements [3,4].

These characteristics demonstrate that the ICAO framework should be regarded as a technical and regulatory classification rather than a functional one. Airports possessing identical Aerodrome Reference Codes may perform entirely different roles within national and international aviation systems because the framework classifies infrastructure rather than airport functions.

2.3 ACI Airport Classification Approach

Representing airport operators worldwide, the Airports Council International (ACI) approaches airport classification from an industry and management perspective rather than a regulatory one. Its principal objective is to promote the sustainable development of airports through benchmarking, operational improvement and the dissemination of industry best practices [6].

Unlike the ICAO framework, ACI does not prescribe a formal airport classification system. Instead, it employs several complementary approaches designed to support airport benchmarking, economic analysis, operational performance assessment and strategic planning. Within this context, the primary object of classification is the airport as an operating enterprise, evaluated through operational, financial and service-performance indicators.

Airport classification in ACI publications is determined largely by passenger traffic, aircraft movements, cargo throughput, airport capacity, market characteristics and operational performance. These indicators facilitate meaningful comparisons between airports with similar scales of activity and support performance benchmarking across the global airport industry [6].

Passenger traffic remains the principal variable throughout most ACI analytical publications. Airports are commonly grouped according to annual passenger volumes to compare operational efficiency, financial performance, service quality and infrastructure utilisation. Depending upon the objectives of a particular study, additional variables—including cargo activity, ownership structure and regional market characteristics—may also be considered.

ACI further recognises that airports perform different functions within national and international air transport systems. Consequently, its analytical reports frequently distinguish between large hub airports, metropolitan airports, regional airports, tourist airports and cargo-oriented airports. These groupings support comparative analysis and benchmarking rather than regulatory classification.

In recent years, the ACI approach has expanded beyond traditional traffic indicators to include airport resilience, environmental sustainability, digital transformation and customer experience. Benchmarking therefore increasingly incorporates operational efficiency, financial sustainability, environmental performance and service quality as complementary measures of airport performance.

Collectively, these characteristics illustrate how the ACI approach complements the ICAO framework. Whereas ICAO classifies aviation infrastructure from a regulatory perspective, ACI evaluates airports as operating organisations whose performance can be measured, compared and continuously improved.

2.4 IATA Airport Classification Approach

Whereas ACI evaluates airports principally from the perspective of airport management and organisational performance, the International Air Transport Association (IATA) approaches airport classification from the standpoint of commercial air transport operations. Representing the global airline industry, IATA develops standards, recommended practices and technical guidance supporting airline operations, airport planning and passenger processing [7].

Unlike regulatory frameworks established by States, IATA does not maintain a formal airport classification framework based on administrative or legal categories. Instead, it applies an operational approach intended to support airport development, terminal planning, airline operations and capacity management. Within this approach, the primary object of classification is the airport as a commercial air transport facility, particularly in relation to airline operations, passenger processing and infrastructure planning.

The principal reference document is the Airport Development Reference Manual (ADRM), which provides internationally recognised guidance for airport planning, terminal design, passenger flow analysis, baggage handling systems and operational capacity assessment [7]. Rather than assigning airports to predefined classes, the manual establishes planning principles applicable to airports with different traffic volumes, operational characteristics and business models.

Airport characteristics are evaluated largely through passenger demand, terminal functions, airline operating models, transfer activity, aircraft turnaround requirements and the level of service provided to passengers. These operational characteristics determine planning requirements far more directly than administrative airport status or ownership.

Particular attention is given to the interaction between airport infrastructure and airline operations. Passenger processing, baggage systems, security screening, border control procedures and aircraft turnaround are therefore considered components of an integrated operational system. Consequently, airports serving network carriers, low-cost airlines, cargo operators or mixed traffic frequently require different planning solutions despite possessing similar physical infrastructure.

Viewed within the broader context of airport classification, the IATA approach complements both the ICAO regulatory framework and the ACI management perspective. Whereas ICAO establishes technical infrastructure requirements and ACI evaluates airport performance, IATA concentrates on the operational interface between airports, airlines and passengers.

2.5 EUROCONTROL Network Classification Approach

Rather than regulating airport infrastructure or representing airport operators, the European Organisation for the Safety of Air Navigation (EUROCONTROL) supports the management of the European Air Traffic Management (ATM) Network and promotes the safe, efficient and coordinated use of European airspace [8]. Its perspective therefore differs fundamentally from those adopted by ICAO, ACI and IATA.

Within this approach, the primary object of classification is the airport as a node within the Air Traffic Management network. Airport significance is determined not only by local infrastructure or passenger traffic but also by its interaction with surrounding airspace, traffic flows and overall network performance.

EUROCONTROL does not establish a formal airport classification system based upon administrative categories. Instead, airports are differentiated according to their operational influence on the European ATM network and their contribution to overall network efficiency.

Airport characteristics are evaluated through traffic density, operational complexity, capacity utilisation, runway throughput, delay generation, resilience and interaction with ATM systems [8]. Particular attention is given to airports whose performance significantly influences traffic flows extending across multiple States.

The network perspective also recognises that airports perform fundamentally different roles within the European aviation system. Intercontinental hubs, regional airports, seasonal tourist airports, cargo gateways and business aviation airports interact with the ATM network in different ways and consequently generate different operational challenges. Although these distinctions are not expressed as formal regulatory categories, they implicitly acknowledge functional differences between airports.

A further characteristic of the EUROCONTROL approach is its emphasis on dynamic network behaviour rather than static infrastructure characteristics. Airport importance may therefore vary according to traffic demand, airspace capacity, weather conditions and operational disruptions affecting the wider European aviation network.

This systems perspective expands the understanding of airport classification beyond infrastructure and airport management by considering airports as interconnected elements of a complex transportation network. It therefore provides an important conceptual bridge between traditional airport classification and broader systems analysis.

Collectively, the approaches developed by ICAO, ACI, IATA and EUROCONTROL demonstrate that international organisations classify airports from different institutional perspectives. Additional international organisations employ airport categorisation for specialised analytical purposes, although without establishing comprehensive classification frameworks.

2.6 Other International Classification Approaches

Beyond the approaches developed by ICAO, ACI, IATA and EUROCONTROL, several international organisations contribute to airport classification through specialised operational, economic and analytical activities. Although these organisations generally do not establish comprehensive airport classification frameworks, they employ airport categorisation to support specific aviation objectives.

Examples include the Civil Air Navigation Services Organisation (CANSO), the Organisation for Economic Co-operation and Development (OECD), the World Bank and various regional aviation organisations. Their publications commonly classify airports according to operational performance, connectivity, economic impact, infrastructure development, accessibility and environmental sustainability.

International statistical databases maintained by ICAO, the World Bank and other organisations also categorise airports using standardised indicators such as passenger traffic, aircraft movements and cargo throughput. These classifications facilitate international benchmarking and long-term statistical analysis but are not intended to define airport functions or regulatory categories.

Growing attention has also been directed towards environmental sustainability and climate resilience. Airports are increasingly compared according to carbon management programmes, environmental certification, energy efficiency and sustainable development objectives. Such approaches support environmental benchmarking and policy development rather than airport regulation.

Academic research has further broadened airport classification through quantitative measures of connectivity, accessibility and network centrality. These methods evaluate airports according to their position within regional and global transport networks using indicators derived from traffic flows and network analysis. Although these approaches provide valuable analytical insights, they generally address specific research questions rather than establish universally applicable airport classification frameworks.

Taken together, these international approaches illustrate the increasing diversity of airport classification criteria. They reflect the growing importance of operational efficiency, environmental sustainability, network connectivity and economic performance within contemporary aviation. At the same time, they demonstrate that existing international approaches remain focused on particular institutional or analytical objectives rather than providing a comprehensive functional classification applicable across the full spectrum of airport activities.

National Airport Classification Systems

Although international organisations establish the common regulatory and technical foundation for airport classification, the practical implementation of these principles is undertaken by national aviation authorities. National classification systems are shaped not only by internationally recognised standards but also by domestic legislation, transportation policy, geographical conditions and socio-economic priorities. As a result, airports performing similar operational functions may be assigned to different administrative categories in different countries.

The following sections examine representative national airport classification systems developed by four major aviation States. Together, they illustrate how common international principles are adapted to address diverse national transportation requirements while reflecting different regulatory philosophies and strategic objectives.

2.7 United States (FAA)

Among national airport classification systems, the framework developed by the Federal Aviation Administration (FAA) is one of the most comprehensive and widely documented. Designed to support airport planning, infrastructure funding, safety oversight and national transportation policy, it reflects the scale and diversity of the United States airport network, which comprises more than 19,000 airports, including over 3,000 public-use facilities [9–11].

Unlike the ICAO framework, which establishes technical design standards for aerodromes, the FAA system classifies airports according to the roles they perform within the national transportation network. Accordingly, the primary object of classification is the airport as a component of the national air transportation system.

The principal classification is defined through the National Plan of Integrated Airport Systems (NPIAS), which identifies airports considered significant to national air transportation and therefore eligible for federal investment through the Airport Improvement Program (AIP) [9,10].

Within the NPIAS, airports are grouped into four principal categories: Primary Airports, Commercial Service Airports, Reliever Airports, and General Aviation Airports. These categories reflect the transportation role of each airport rather than its physical infrastructure alone.

Primary Airports are public-use commercial service airports recording more than 10,000 annual passenger enplanements. Commercial Service Airports provide scheduled passenger service and handle at least 2,500 annual passenger enplanements. Reliever Airports are designated to reduce congestion at major commercial airports by accommodating general aviation traffic, whereas General Aviation Air-

ports support business aviation, recreational flying, emergency services, agricultural aviation, pilot training and numerous specialised aviation activities [9,10].

For FAA statistical purposes, enplanements represent revenue passengers boarding an aircraft and constitute the principal indicator used for airport classification, infrastructure planning and eligibility for federal funding.

Primary Airports are further subdivided according to their percentage share of total annual passenger enplanements within the United States. The resulting categories are summarised in Table 2.1.

Table 2.1. FAA NPIAS airport categories

Category	Share of U.S. annual passenger enplanements
Large Hub	$\geq 1.0\%$
Medium Hub	$0.25\% - <1.0\%$
Small Hub	$0.05\% - <0.25\%$
Nonhub Primary	$>10,000$ annual enplanements and $<0.05\%$

This hierarchy is based on an airport's relative share of national passenger traffic rather than on absolute passenger numbers. Consequently, an airport's hub designation may change over time as national traffic volumes and market shares evolve.

Beyond the NPIAS, the FAA employs additional classifications supporting airport certification, engineering design and infrastructure planning. These include certification requirements established under Title 14 Code of Federal Regulations (14 CFR Part 139) together with airport design standards contained in Advisory Circular AC 150/5300-13 – Airport Design [10,11].

Collectively, these characteristics demonstrate that the FAA system extends beyond administrative categorisation to reflect the functional role of airports within the national transportation network. Although originally developed for planning and federal investment, many FAA categories correspond closely to distinct airport functions.

The FAA classification system is distinguished by its direct integration with national transportation policy and federal airport funding. Unlike most international approaches, airport categories determine eligibility for infrastructure investment through the Airport Improvement Program. Another characteristic feature is the use of relative passenger enplanements, rather than absolute passenger numbers, to define hub categories. Consequently, airport classification evolves dynamically as national traffic patterns change while maintaining a consistent national hierarchy.

2.8 China (CAAC)

China's remarkable growth in civil aviation has been accompanied by the development of one of the world's largest and most centrally coordinated airport systems. Administered by the Civil Aviation Administration of China (CAAC), the national framework supports a rapidly expanding network of airports that serves both domestic and international aviation while contributing to broader economic and regional development objectives [12].

In contrast to the FAA system, which emphasises transportation roles within a competitive national network, the CAAC system combines administrative, operational and strategic planning considerations. Within this system, the primary object of classification is the airport as an element of the national airport system and strategic transport infrastructure.

Airport classification reflects a combination of passenger traffic, cargo throughput, operational capability, route network development, administrative importance and long-term strategic significance. Rather than relying upon fixed numerical thresholds, airport categories are established through comprehensive government planning and are periodically revised in accordance with national civil aviation development programmes [12].

The Chinese airport network broadly comprises International Hub Airports, Regional Hub Airports, Regional Airports and General Aviation Airports. These categories recognise both present operational performance and anticipated future development. Consequently, airport designation reflects not only existing traffic demand but also projected economic growth, regional accessibility and national transportation priorities.

A defining characteristic of the Chinese system is its close integration with government infrastructure planning. Airport development programmes are coordinated with broader strategies for economic growth, regional integration and international connectivity. Major hub airports strengthen China's global aviation network, whereas regional airports support balanced territorial development and improved domestic accessibility.

Significant investment has also been directed towards airports serving western provinces, border regions and rapidly developing metropolitan areas. Many of these facilities have been developed in anticipation of future transportation demand rather than solely in response to existing traffic levels. Airport significance is therefore determined through a combination of operational performance and strategic planning considerations.

Taken together, these characteristics illustrate how airport classification can become an integral component of national infrastructure policy. The CAAC system demonstrates that airport categories may simultaneously reflect operational requirements, regional development objectives and long-term national planning priorities.

The CAAC system is distinguished by its close integration with national strategic planning and infrastructure development. Airport categories reflect not only operational performance but also future transport demand, regional accessibility and government investment priorities. This planning-oriented philosophy represents one of the most centrally coordinated airport classification systems currently employed within global civil aviation.

2.9 India

The rapid expansion of India's civil aviation sector over the past two decades has fundamentally transformed the country's airport network. Responding to sustained economic growth, rising passenger demand and ambitious national development programmes, India has established an airport classification system that supports both commercial aviation and regional accessibility. Responsibility for airport planning, regulation and operational oversight is shared by the Airports Authority of India (AAI), the Directorate General of Civil Aviation (DGCA) and the Ministry of Civil Aviation (MoCA) [13,14].

Rather than focusing exclusively on transportation hierarchy, as in the United States, or on centrally coordinated infrastructure planning, as in China, the Indian system combines operational classification with broader socio-economic objectives. Accordingly, the primary object of classification is the airport as a component of the national and regional air transport network, supporting commercial activity while promoting territorial accessibility.

Airport classification reflects a combination of international or domestic operations, passenger demand, operational capability, ownership and management structure, regional importance and participation in national connectivity programmes. These characteristics are considered collectively, allowing airport designation to support transportation policy as well as infrastructure planning [13,14].

The Indian airport network comprises International Airports, Domestic Airports, Customs Airports, Regional Airports and General Aviation Airports. International Airports support scheduled international passenger and cargo services, whereas Domestic Airports primarily accommodate internal air transport. Customs Airports possess customs and immigration facilities that permit limited international operations, including charter and cargo flights. Regional Airports contribute to domestic connectivity, particularly in underserved areas, while General Aviation Airports support business aviation, flight training, emergency services and other specialised aviation activities.

A defining element of India's airport policy is the Regional Connectivity Scheme (UDAN), introduced to improve access to air transport in underserved and previously unserved regions. Through this pro-

gramme, numerous airports have been modernised, reactivated or newly developed to stimulate regional economic development, tourism and social integration. Airport significance is therefore influenced not only by existing traffic demand but also by anticipated contributions to regional accessibility and balanced national development [14].

The continued expansion of privately operated airports and new greenfield developments has further diversified the national airport system. Large international gateways, rapidly growing metropolitan airports and an increasing number of regional facilities now perform complementary functions within a rapidly evolving transportation network.

These characteristics demonstrate that the Indian system integrates operational requirements with broader public policy objectives. Airport classification therefore supports both the efficient management of commercial aviation and the long-term development of regional connectivity.

The Indian airport classification system is distinguished by its strong emphasis on regional connectivity and socio-economic development. Through the UDAN programme, airport classification is closely linked to improving accessibility for underserved regions rather than responding solely to existing passenger demand. This policy-oriented approach demonstrates how airport classification can contribute directly to broader national development objectives.

2.10 Russian Federation

The airport system of the Russian Federation has evolved under unique geographical, climatic and administrative conditions. As the world's largest country by land area, Russia relies heavily on aviation to maintain transportation links between major metropolitan centres and remote territories. Consequently, airports perform not only commercial transport functions but also essential social, economic and strategic roles within the national transportation system [15,16].

Unlike several national systems that employ a single integrated classification methodology, the Russian Federation applies a combination of complementary regulatory and administrative mechanisms. Airport categorisation is established through the Air Code of the Russian Federation, regulations issued by the Ministry of Transport and the oversight functions of the Federal Air Transport Agency (Rosaviatsiya). Together, these instruments define airport status, certification requirements, operational characteristics and administrative designation within the national civil aviation system [15,16].

Airport classification reflects a combination of international or domestic status, federal or regional significance, public-use or joint-use designation, operational capability, passenger and cargo activity and strategic importance within the national transportation network. These characteristics are applied through different regulatory instruments depending on the purpose of classification, including certification, airport administration and state planning.

Airports authorised to handle international air services receive international airport status following approval by the Government of the Russian Federation and the establishment of customs, border control and other state control services. Airports serving exclusively domestic operations retain domestic status regardless of passenger volume or infrastructure size [15].

The Federal Air Transport Agency (Rosaviatsiya) maintains the State Register of Civil Aerodromes and Airports of the Russian Federation and is responsible for airport certification, regulatory oversight and implementation of federal aviation regulations. Through these responsibilities, Rosaviatsiya plays a central role in the practical administration of airport classification throughout the national civil aviation system [16].

An important characteristic of the Russian regulatory framework is the legal distinction between the concepts of an aerodrome and an airport. According to the Air Code of the Russian Federation, an aerodrome is a designated area of land or water, together with associated buildings, installations and equipment, intended wholly or partly for the arrival, departure and surface movement of aircraft. An airport, by contrast, is an integrated transport complex that includes one or more aerodromes together with passenger terminals, cargo facilities and other infrastructure required for commercial air transport operations [15].

This distinction has important regulatory implications because requirements applicable to aerodromes do not necessarily apply to airports as complete transportation facilities. Accordingly, the primary object of classification depends upon the regulatory context and may refer either to the aerodrome as aviation infrastructure or to the airport as an integrated transport facility. This distinction is particularly significant for comparative international studies, where the object of classification is not always defined consistently.

Operationally, the Russian airport network includes major metropolitan hubs, regional airports, airports serving northern and eastern territories, and specialised facilities supporting industrial, governmental and resource-development activities. Airports frequently perform multiple functions simultaneously by accommodating scheduled passenger services, cargo transportation, emergency operations, governmental flights and regional accessibility.

A defining characteristic of the Russian airport network is the importance of geographically remote airports. Throughout Siberia, the Far East and the Arctic, airports provide year-round access to communities where alternative surface transport is limited or unavailable. Their significance is therefore determined not only by passenger demand but also by the provision of essential public services and the maintenance of territorial accessibility.

Government programmes supporting airport modernisation and regional aviation continue to influence infrastructure development priorities. Investment decisions frequently reflect national transportation policy, strategic development objectives and regional accessibility alongside commercial demand.

Taken together, these characteristics demonstrate that airport significance within the Russian Federation cannot be assessed solely through passenger traffic or economic performance. Geographic isolation, climatic conditions and the provision of essential transportation services represent equally important determinants of airport function.

The Russian airport system is distinguished by the exceptional importance of territorial accessibility across a vast geographical area. Airport significance is influenced not only by commercial activity but also by the provision of essential transport services to remote and isolated regions. Furthermore, Russian aviation legislation clearly distinguishes between aerodromes and airports, illustrating that the object of airport classification may itself vary according to the applicable regulatory framework.

2.11 Other National Classification Systems

Beyond the major aviation States discussed above, numerous countries have developed airport classification systems tailored to their own regulatory environments, transportation policies and operational requirements. Although these systems differ in terminology and administrative implementation, they generally apply principles comparable to those adopted internationally while addressing national priorities and institutional structures.

Many European States classify airports according to legal status, ownership, operational capability and participation in national transportation networks. These classifications are typically established through national aviation legislation while remaining consistent with ICAO Standards and Recommended Practices and the broader European regulatory framework.

Countries including Canada, Australia and Japan distinguish airports according to combinations of international and domestic status, passenger demand, infrastructure capability, ownership arrangements and administrative responsibility. Although terminology varies among jurisdictions, these systems broadly differentiate major international gateways, regional airports and facilities supporting specialised aviation activities.

Several States maintain separate classifications for airports serving remote communities, island territories or sparsely populated regions. In these cases, airport designation reflects public service obligations and national accessibility objectives alongside commercial demand. Similar approaches may be observed in Nordic countries, island States and geographically dispersed national territories where aviation provides essential transportation services.

Developing countries increasingly integrate airport classification into long-term infrastructure planning and national economic development programmes. Airport categories therefore evolve alongside changes in passenger demand, regional development priorities and investment strategies. Consequently, airport classification frequently serves as an instrument of transportation policy in addition to its administrative and statistical functions.

Collectively, national airport classification systems demonstrate considerable diversity in terminology, regulatory implementation and administrative objectives. At the same time, they reveal common underlying principles. Most combine technical, operational, administrative and economic considerations while adapting these criteria to national geographical, institutional and transportation contexts.

These observations reinforce one of the central conclusions of the present chapter: airports performing similar operational functions may belong to entirely different administrative categories in different countries. The distinction between administrative classification and functional role therefore provides an important conceptual foundation for the comparative analysis presented in the following chapter.

2.12 Academic Approaches to Airport Classification

2.12.1 Introduction

Unlike regulatory and administrative frameworks, academic research approaches airports primarily as objects of scientific investigation rather than regulatory classification. Instead of assigning airports to categories for certification, funding or governmental planning, researchers seek to explain airport characteristics through engineering, operational, economic and systems-based analytical frameworks. Consequently, airport classification in academic literature serves primarily as a research instrument for understanding airport diversity rather than as a mechanism for regulatory decision-making.

Academic approaches have evolved within several independent research traditions, each addressing a particular aspect of airport development and operation. These traditions employ different methodological assumptions, analytical objectives and terminology while examining airports from complementary perspectives. Collectively, they have significantly expanded the theoretical understanding of airports beyond the administrative and regulatory classifications employed by international organisations and national aviation authorities.

The principal academic traditions relevant to the present study comprise engineering and airport-planning approaches, operational and service-oriented perspectives, airport-system and network models, and economic and management approaches. Although each contributes valuable insights into airport characteristics, none individually provides a comprehensive framework for classifying airports according to the functions they perform [1,2].

2.12.2 Engineering and Airport Planning Approaches

Engineering has historically provided the foundation of academic airport research. Classical airport planning literature considers the airport principally as a transportation facility whose characteristics are determined by aircraft requirements, traffic demand, operational capacity and engineering standards. Seminal works by Horonjeff et al., Ashford et al., and Kazda and Caves analyse airports through such variables as runway configuration, aircraft characteristics, terminal planning, apron layout, land-side access, operational capacity and infrastructure compatibility [1,17,18].

A defining feature of engineering approaches is the Design Aircraft Concept, whereby airport facilities are planned around the operational requirements of the most demanding aircraft intended to use the airport on a regular basis. Runway geometry, taxiway systems, apron dimensions, separation standards and numerous other engineering parameters are consequently determined primarily by aircraft characteristics rather than by the broader transportation role of the airport [17,18].

Within this analytical tradition, airports are generally differentiated according to measurable technical and operational characteristics instead of their broader purpose within the air transport system. Ac-

cordingly, the airport or aerodrome is examined primarily as an engineered transportation facility whose physical characteristics must satisfy defined operational requirements.

Engineering and airport-planning research has established the theoretical basis for airport design, infrastructure compatibility and capacity analysis. These approaches provide rigorous methods for evaluating airport facilities and remain indispensable for airport planning and development. Nevertheless, airports possessing similar physical infrastructure and design standards may perform substantially different functions within regional, national or international aviation systems. Engineering models therefore explain how airports should be designed but only partially explain why airports of similar technical characteristics fulfil different transportation functions.

2.12.3 Operational and Functional Approaches

As airport planning evolved, academic research increasingly recognised that airport facilities cannot be analysed independently of the activities they support. Operational studies therefore shifted attention from infrastructure itself towards the services, processes and interactions that occur within the airport environment. Ashford et al., for example, integrate passenger processing, aircraft operations, cargo handling, terminal activities, landside access and ground transportation into a unified framework for airport planning and development [1].

This operational perspective broadens airport analysis by recognising that airports differ according to the services they provide, the traffic they accommodate and the operational processes they support. Passenger airports, cargo airports, general aviation facilities and mixed-use airports consequently exhibit distinct operational profiles even where their physical characteristics appear broadly comparable.

An important contribution of operational research is the recognition that airport functions are dynamic rather than fixed. Changes in airline business models, passenger demand, cargo activity, regulatory requirements or regional transportation needs may substantially alter the functional profile of an airport over time, even when its physical infrastructure remains largely unchanged. This dynamic perspective represents a significant conceptual advance beyond purely engineering-based analyses.

Operational approaches therefore move closer to functional classification by acknowledging that airports frequently perform several functions simultaneously and that these functions evolve throughout an airport's life cycle. Function is recognised as an important analytical dimension, although it generally remains one characteristic among several rather than serving as the organising principle of a unified airport classification framework.

2.12.4 Airport Systems and Network Approaches

A broader academic tradition considers airports not as isolated transportation facilities but as components of interconnected aviation systems. This perspective emerged from the recognition that airport performance and significance are determined not only by local infrastructure or traffic demand but also by relationships with surrounding airports, airline networks and regional transportation systems. De Neufville and Odoni emphasise airport systems, uncertainty, traffic distribution and the interactions between individual airports and the metropolitan or regional markets they serve [2].

Within this analytical perspective, the focus extends beyond the individual airport to include its position within an airport system and the wider air transport network. Concepts such as hubs, secondary airports, feeder airports, gateway airports, multiple-airport systems and connectivity therefore become essential for understanding airport behaviour and significance.

Research in transport geography and network science has demonstrated that airports with comparable traffic volumes may occupy fundamentally different positions within the same aviation system. Measures of connectivity, centrality and traffic generation provide additional means of differentiating airports that cannot be inferred solely from passenger volumes or physical infrastructure [22,23].

Network research further demonstrates that airports form hierarchical systems in which individual facilities perform complementary roles, including hub, secondary, feeder, gateway and regional accessibility functions. These functions emerge from the structure of the transportation network itself rather

than from airport size alone. Consequently, airport significance depends as much upon inter-airport relationships as upon the characteristics of individual airports [22,23].

Recent studies have also applied quantitative clustering and benchmarking techniques to identify groups of airports exhibiting comparable operational or economic characteristics. Instead of relying upon predefined administrative categories, these methods derive airport groupings from observed performance indicators, network characteristics and operational data. Such approaches provide an empirical basis for airport differentiation while demonstrating that statistically derived groupings may differ substantially from regulatory classifications [21].

Airport systems and network approaches therefore broaden the understanding of airport classification by recognising that airport functions depend partly upon relationships with other airports and with the wider air transport system. A relatively small airport may perform a strategically important feeder, connecting or accessibility role, whereas airports of comparable traffic size may fulfil entirely different functions within their respective national or international aviation networks.

2.12.5 Economic and Management Approaches

The commercialisation and privatisation of airports have generated a substantial body of academic research in which airports are examined as economic and organisational entities. Rather than concentrating on infrastructure or operational processes, this literature investigates airport governance, ownership, competition, financial performance, airline relationships and business strategy. Graham analyses airport management from institutional and commercial perspectives, while Doganis places airport activities within a broader economic and financial framework [19,20].

Within this research tradition, the airport is viewed primarily as an economic enterprise. Airports may therefore be differentiated according to ownership structure, governance model, market position, traffic composition, revenue sources, commercial orientation and long-term business strategy.

Contemporary airport economics has considerably expanded this perspective by examining economic regulation, pricing policies, investment strategies, public-private partnerships and the relationship between governance structures and airport performance [24]. These studies contribute significantly to understanding how institutional arrangements influence airport development, financial sustainability and long-term competitiveness.

Another important area of research concerns airport competition and market dynamics. Recent studies demonstrate that airports possessing similar infrastructure and traffic characteristics may operate under fundamentally different competitive conditions depending upon airline networks, ownership structures, geographical location and regional market characteristics [19,24]. Commercial performance therefore cannot be interpreted solely as a function of airport size or passenger demand.

Economic and management approaches provide an essential dimension of airport analysis by explaining how airports operate as business organisations within increasingly competitive aviation markets. Nevertheless, commercial characteristics do not necessarily correspond to transportation functions. Airports performing similar operational roles may differ substantially in ownership, governance and financial performance, while commercially comparable airports may fulfil very different functions within regional or international aviation systems.

2.12.6 Synthesis

Academic research offers several complementary perspectives for analysing airports. Engineering studies emphasise infrastructure and design requirements; operational approaches focus on airport activities and service characteristics; systems research examines network position, hierarchy and connectivity; while economic literature analyses ownership, governance, competition and commercial performance [1,2,17–24].

Collectively, these studies have substantially broadened the understanding of airports beyond formal regulatory and administrative classifications. They introduce concepts directly relevant to functional

analysis, including multifunctionality, network hierarchy, service profile, accessibility, commercial orientation and the interaction between airport activities and surrounding transportation systems.

The reviewed literature also demonstrates that airport functions cannot be explained from a single disciplinary perspective. Engineering approaches describe infrastructure requirements; operational studies examine airport processes; network research explains relationships between airports; and economic analyses investigate business behaviour and institutional development. Each contributes valuable insights while addressing only one dimension of a considerably more complex phenomenon.

These observations indicate that the remaining challenge is not the absence of airport classifications themselves, but the absence of a comprehensive framework capable of consistently classifying airports according to the functions they perform across different regulatory, operational and geographical contexts. The existing body of research therefore provides the conceptual foundation, but not a unified methodology, for the development of a comprehensive functional airport classification.

2.13 Summary

The classification systems reviewed in this chapter demonstrate the diversity of perspectives from which airports may be understood and differentiated. International organisations establish technical, managerial, commercial and network-oriented approaches. National aviation authorities adapt airport classification to domestic legislation, transportation policy, infrastructure development and territorial priorities. Academic research complements these perspectives through engineering, operational, systems and economic analytical traditions.

An important observation emerging from this review is that existing approaches differ not only in their classification criteria but also in the object of classification itself. ICAO focuses principally on the aerodrome as aviation infrastructure; ACI considers the airport as an operating enterprise; IATA examines the airport as a commercial air transport facility; EUROCONTROL analyses it as a component of the air traffic management network; national systems generally classify airports as elements of national transportation infrastructure; while academic research investigates airports from engineering, operational, network or economic perspectives depending upon the objectives of individual studies. Table 2.2 summarises these differences across the principal approaches reviewed.

Table 2.2. Comparison of existing airport classification systems

Approach	Primary object	Principal criteria	Primary purpose	Primary perspective
ICAO Framework	Aerodrome	Aircraft and infrastructure characteristics	Technical standardisation	Regulatory
ACI Approach	Airport as operating enterprise	Traffic, performance, economics	Benchmarking and management	Management
IATA Approach	Commercial airport facility	Airline operations, passenger processes, capacity	Airport planning	Commercial
EUROCONTROL Approach	Airport as network node	ATM interaction, capacity, network performance	Network management	Systems
FAA System	Airport within the national network	Service role, enplanements, traffic share	Planning and funding	Transportation
CAAC System	Strategic airport infrastructure	Traffic, network role, development priorities	National planning	Government planning
India System	Airport within the national/regional network	Operational status, connectivity	Regional development	Government planning
Russian System	Airport / aerodrome	Regulatory status, operational role, territorial accessibility	Administration	Government planning
Academic approaches	Varies according to research perspective	Infrastructure, operations, networks, economics	Scientific analysis	Scientific

Taken together, the systems reviewed in this chapter demonstrate the diversity of purposes, objects and criteria used in airport classification. They provide the empirical and conceptual basis for the systematic comparison undertaken in Chapter 3.

Chapter 3

Comparative Analysis of Existing Airport Classification Systems

3.1 Introduction

Chapter 2 reviewed the principal airport classification systems developed by international organisations, national aviation authorities and the academic community. Although these approaches differ considerably in scope, terminology and implementation, they collectively represent the current state of airport classification theory and practice.

The review demonstrates that airport classification is not a single, universally defined concept. Instead, existing systems have evolved to satisfy different regulatory, operational, managerial and research objectives. Consequently, the differences between classification systems extend beyond terminology and classification criteria to include the object of classification itself, the methodological assumptions on which each framework is based and the context in which it is intended to be applied.

These differences present a significant challenge for comparative airport analysis. Airports assigned to similar categories in different systems do not necessarily perform comparable roles, while airports performing similar functions may be classified differently because the underlying objectives and analytical perspectives are not the same. Direct comparison therefore requires a common analytical framework independent of the individual purposes for which existing classifications were originally developed.

The purpose of this chapter is not to evaluate individual classification systems in isolation but to compare them using a common analytical framework based on four complementary dimensions: the objectives of classification, the object of classification, the classification criteria employed and the practical applicability of each approach. This comparative analysis establishes the methodological foundation for identifying the requirements of a comprehensive functional airport classification developed in the following chapters.

3.2 Comparison of Classification Objectives

Although all airport classification systems seek to organise airports into meaningful categories, the objectives for which they were developed differ substantially. These objectives reflect the institutional responsibilities of the organisations responsible for the classifications and largely determine both their structure and the criteria employed. Understanding these differences is essential because classification systems designed for different purposes cannot be expected to produce directly comparable results.

Table 3.1 summarises the principal objectives of the classification systems reviewed in Chapter 2.

Table 3.1. Primary objectives of existing airport classification systems

Classification system	Primary objective
ICAO	Technical standardisation, safety and interoperability
ACI	Airport management, benchmarking and performance assessment
IATA	Airport planning, airline operations and commercial coordination
EUROCONTROL	Air traffic management and network optimisation
FAA	National transportation planning and federal funding allocation
CAAC	Strategic infrastructure planning and national aviation development
India	Regional accessibility and national transport policy
Russian Federation	Airport administration, territorial accessibility and regulatory oversight
Academic approaches	Scientific analysis and theoretical understanding

The comparison demonstrates that airport classification is generally developed as a means of achieving broader institutional objectives rather than as an objective in itself. International organisations primarily support technical harmonisation, operational efficiency and network coordination. National authorities employ airport classification as an instrument of transportation planning, infrastructure investment and public administration. Academic approaches, in contrast, seek to explain airport characteristics, relationships and development patterns rather than regulate airport activities.

Although these objectives differ, they are not mutually exclusive. Several classification systems simultaneously support regulatory, operational and planning activities, while academic research frequently contributes concepts later adopted by practitioners and regulatory organisations. The boundaries between objectives are therefore neither rigid nor exclusive, but reflect the primary emphasis of each framework.

The comparison also demonstrates that the intended objective directly influences the structure of every classification system. Technical objectives lead naturally to classifications based on infrastructure and aircraft compatibility. Planning objectives emphasise traffic demand, service provision and transportation roles. Management objectives focus on organisational performance, while research objectives seek to explain airport behaviour through analytical models. Consequently, the choice of classification criteria cannot be understood independently of the objectives the classification is intended to achieve.

From a methodological perspective, this diversity of objectives explains why no single airport classification has achieved universal acceptance. Existing systems were developed to solve different practical and scientific problems rather than to establish a common conceptual framework applicable across all areas of civil aviation. Their diversity therefore reflects the diversity of airport functions, institutional responsibilities and research perspectives rather than inconsistency among the classification systems themselves.

The comparison of objectives provides the first indication that airport classification should be viewed as a multidimensional concept rather than a single universal taxonomy. This observation forms the basis for the subsequent comparison of the objects of classification, where even greater methodological differences become apparent.

3.3 Comparison of Classification Objects

One of the most significant findings emerging from the review presented in Chapter 2 is that existing airport classification systems do not classify the same object. Although the term airport classification is widely used throughout aviation literature, different organisations and researchers apply it to fundamentally different entities. Consequently, apparent similarities between classification systems often conceal important methodological differences.

The object of classification is determined primarily by the purpose of the respective framework. Systems developed for infrastructure design focus on the aerodrome and its physical characteristics. Approaches intended for airport management consider the airport as an operating enterprise. Air traffic management organisations evaluate airports as components of an aviation network, whereas economic studies analyse airports as commercial organisations. National authorities frequently classify airports according to their role within domestic transportation systems or administrative structures.

These objects also represent different levels of abstraction within the airport system. Infrastructure-oriented approaches examine physical facilities; operational approaches focus on airport activities; network models analyse relationships between airports; management frameworks evaluate organisational performance; while national classifications frequently combine several of these perspectives within a single administrative system. The observed diversity therefore reflects differences in analytical perspective rather than inconsistency among the classifications themselves. The comparison is summarised in Table 3.2.

Table 3.2. Comparison of classification objects

Classification system	Primary object of classification
ICAO	Aerodrome
ACI	Airport as an operating enterprise
IATA	Airport as a commercial air transport facility
EUROCONTROL	Airport as a node within the air traffic management network
FAA	Airport within the national transportation system
CAAC	Airport as strategic transport infrastructure
India	Airport within the national and regional transport network
Russian Federation	Airport or aerodrome, depending on the regulatory context
Academic approaches	Varies according to the analytical perspective

The comparison demonstrates that no universally accepted object of airport classification currently exists. Instead, each framework defines its object according to its institutional responsibilities and intended application. Consequently, the same airport may simultaneously be regarded as an aerodrome, a transportation facility, a business enterprise, a network node or an element of national infrastructure depending upon the analytical perspective adopted.

This diversity should not be interpreted as a methodological weakness. On the contrary, each framework classifies the object most relevant to its intended purpose. ICAO is principally concerned with infrastructure compatibility and operational safety; ACI focuses on airport performance and management; EUROCONTROL analyses network interactions; while national authorities support transportation planning and public administration. Academic research likewise examines airports from different disciplinary perspectives depending on the research questions addressed.

From a comparative perspective, however, the absence of a common object of classification creates an important methodological limitation. When different systems classify different objects, their categories cannot be directly compared even when similar terminology is employed. Airports assigned to equivalent categories may therefore perform substantially different roles, while airports performing similar functions may appear in different categories because the underlying objects of classification are fundamentally different.

These observations suggest that a comprehensive airport classification requires a broader conceptual perspective capable of integrating these different levels of abstraction. Rather than considering infrastructure, management, network position or administrative status independently, such a framework should explain how these dimensions collectively influence the role performed by an airport within the air transport system.

3.4 Comparison of Classification Criteria

Although existing airport classification systems pursue different objectives and classify different objects, they also employ substantially different criteria for differentiating airports. These criteria reflect the specific tasks each system was designed to address and therefore determine the practical scope and applicability of the resulting classifications.

The review presented in Chapter 2 demonstrates that no single criterion is common to all existing airport classification systems. Instead, individual approaches select those characteristics that best support their intended regulatory, operational, managerial or analytical objectives. Table 3.3 compares the principal criteria used by the systems reviewed.

Table 3.3. Comparison of principal classification criteria

Classification system	Infra-structure	Aircraft	Passenger traffic	Cargo	Network role	Operational functions	Admin-istration / Own-ership	Eco-nom-ics
ICAO	✓	✓	—	—	—	—	—	—
ACI	✓	—	✓	✓	—	Partial	—	✓
IATA	Partial	—	✓	✓	Partial	✓	—	—
EUROCONTROL	Partial	—	Partial	—	✓	✓	—	—
FAA	Partial	—	✓	—	✓	✓	✓	—
CAAC	Partial	—	✓	✓	✓	Partial	✓	Par-tial
India	Partial	—	Partial	—	Partial	✓	✓	—
Russian Federa-tion	Partial	—	Partial	Partial	Partial	✓	✓	—
Academic ap-proaches	✓	Partial	✓	✓	✓	✓	Partial	✓

The comparison reveals that existing systems rarely rely upon a single classification criterion. Most combine technical, operational, administrative and economic characteristics, although the relative importance assigned to each criterion varies considerably. International regulatory frameworks primarily emphasise infrastructure and aircraft compatibility, whereas industry organisations focus on traffic, operational performance and service provision. National systems typically integrate operational indicators with transportation policy and administrative requirements, while academic approaches employ combinations of variables determined by specific research objectives.

An equally important observation is that the same criterion may serve different purposes in different classification systems. Passenger traffic, for example, is employed by ACI for benchmarking, by the FAA for planning and funding decisions, and by several national authorities as an indicator of airport significance. Likewise, network role is fundamental to EUROCONTROL's analytical framework but serves as only one of several complementary criteria within most national classification systems.

No criterion appears consistently across all reviewed systems. This finding confirms that classification criteria are selected primarily according to institutional objectives rather than according to a universally accepted methodology. Consequently, airports with similar technical characteristics may differ substantially in operational role, while airports performing comparable functions may be assigned to different categories because different criteria have been given priority.

Operational functions are recognised in several reviewed approaches but generally serve as supporting rather than primary classification criteria. Existing systems acknowledge that airports perform different activities—including passenger transport, cargo handling, general aviation, military support and

regional accessibility—but these functions are usually considered alongside infrastructure, traffic, administrative or economic characteristics rather than forming the principal basis of classification.

From a methodological perspective, the diversity of classification criteria reflects the diversity of objectives identified in the previous section. Infrastructure, traffic volume, network position, ownership and economic characteristics remain essential descriptors of airports. However, these characteristics primarily explain how an airport is designed, managed or operated, whereas airport functions explain the role the airport performs within the wider air transport system. Recognising this distinction provides the conceptual basis for the comparative evaluation presented in the following section.

3.5 Comparative Evaluation of Existing Classification Systems

The comparative analysis presented in the preceding sections demonstrates that existing airport classification systems differ substantially in their objectives, objects of classification and selection of classification criteria. These differences should not be interpreted as methodological weaknesses. On the contrary, each framework has been developed to address a specific set of regulatory, operational, managerial or analytical requirements and is therefore well suited to its intended application.

International classification frameworks provide the technical and operational foundation for global civil aviation. ICAO establishes internationally harmonised infrastructure standards that ensure compatibility between airports and aircraft. ACI supports airport management through benchmarking and performance evaluation, while IATA facilitates airport planning and airline operations. EUROCONTROL complements these approaches by considering airports as components of an integrated air traffic management network. Together, these systems provide comprehensive support for the safe and efficient operation of international aviation.

National airport classification systems fulfil a different role. Rather than pursuing universal applicability, they reflect domestic legislation, transportation policy, geographical conditions and administrative structures. Consequently, the FAA, CAAC, Indian and Russian systems are highly effective within their respective national environments, although their categories cannot always be transferred directly to other countries without adaptation.

Academic approaches contribute an additional dimension by explaining airports from engineering, operational, network and economic perspectives. These studies have significantly expanded the theoretical understanding of airport development and operation while introducing concepts that are now widely applied in airport planning, management and transport research. Their principal contribution lies in explaining airport behaviour rather than establishing universally applicable classification systems.

The comparison demonstrates that the practical applicability of each classification is determined largely by its original purpose. Frameworks developed for airport design emphasise engineering characteristics; systems supporting transportation planning focus on traffic and network roles; management approaches evaluate organisational performance; while academic models investigate particular research questions. Each therefore provides an internally consistent representation of airports, but none attempts to integrate all relevant dimensions within a single framework.

Table 3.4. Comparative characteristics of existing airport classification approaches

Approach	Primary question addressed
Engineering	How should airports be designed?
Operational	How do airports operate?
Management	How should airports be managed?
Network	What role does the airport perform within the air transport network?
Functional	What function does the airport perform within the air transport system?

Table 3.4 illustrates that existing approaches differ primarily in the questions they seek to answer rather than in their scientific validity. Each perspective contributes important knowledge about airports, yet each examines only one aspect of a considerably more complex system. Taken together, they should therefore be regarded as complementary rather than competing approaches to airport classification.

This observation naturally leads to the remaining methodological question addressed in the following section: whether a comprehensive classification centred on airport functions can complement existing systems while remaining fully compatible with their established purposes.

3.6 Identification of the Research Gap

The comparative evaluation demonstrates that existing airport classification systems collectively provide a comprehensive description of many individual aspects of airport activity. Technical frameworks address infrastructure and aircraft compatibility; operational approaches focus on airport services and processes; network models explain relationships within air transport systems; management approaches evaluate organisational performance; while national classifications support transportation policy and regulatory administration.

Taken individually, each of these approaches successfully fulfils its intended purpose. Taken collectively, they provide a broad understanding of airport infrastructure, operations, management and development. Nevertheless, their integration reveals an important methodological observation.

The reviewed systems were developed independently within different institutional and scientific traditions. Consequently, they differ not only in their objectives and classification criteria but also in the fundamental questions they seek to answer. Some explain how airports should be designed, others how they should be managed, regulated or analysed. None was developed specifically to classify airports according to the functions they perform within the air transport system.

A second observation concerns the multidimensional nature of modern airports. Contemporary airports simultaneously perform transportation, operational, economic, logistical and social functions. Depending upon geographical location, airline networks, passenger demand, cargo activity and national transportation policy, these functions may vary substantially even among airports possessing similar infrastructure or traffic volumes. Existing classifications recognise many of these characteristics individually but do not integrate them within a single functional framework.

This observation does not diminish the value of existing classification systems. On the contrary, it reflects the increasing complexity of contemporary aviation. As airport systems have evolved, classification approaches have become progressively more specialised, each addressing a particular regulatory, operational, managerial or research objective. Functional diversity has therefore become a characteristic of airports themselves rather than the principal basis of airport classification.

The comparative evaluation therefore suggests that the remaining methodological challenge is not to replace existing airport classification systems but to complement them with a framework capable of describing airports according to the functions they perform. Such a framework should remain compatible with existing technical, operational and administrative classifications while providing a common analytical perspective applicable across different regulatory and geographical environments.

The research gap identified in the present study may therefore be formulated as follows:

Although numerous airport classification systems exist, no internationally accepted comprehensive framework currently classifies airports primarily according to the functions they perform within the air transport system.

This conclusion follows directly from the comparative analysis presented in this chapter and establishes the scientific motivation for the development of the functional airport classification proposed in the remainder of this monograph.

3.7 Methodological Implications

The comparative analysis presented in this chapter makes it possible to define the principal methodological requirements for a functional airport classification without predetermining its structure or specific categories. These requirements arise directly from the comparison of existing classification systems rather than from the limitations of any individual approach.

First, a functional classification should be universally applicable. Its conceptual principles should not depend upon national legislation, administrative structures or country-specific regulatory frameworks, thereby allowing airports from different States to be analysed within a common methodological framework.

Second, the classification should be function-oriented rather than institution-oriented. Existing systems appropriately classify airports according to infrastructure, management, ownership or operational characteristics. A functional framework should instead focus on the principal role performed by the airport within the air transport system while recognising that airports frequently perform several complementary functions simultaneously.

Third, the proposed framework should remain compatible with existing classification systems. Its purpose is not to replace internationally recognised standards or national regulatory frameworks but to provide an additional analytical dimension that complements established technical, operational and administrative classifications.

Fourth, the framework should recognise the dynamic nature of airport functions. Airport roles evolve in response to changes in airline business models, passenger demand, cargo activity, regional development, technological progress and transportation policy. Consequently, functional classification should accommodate changes in the dominant role of an airport over time without requiring fundamental revision of the classification itself.

Finally, the proposed framework should remain practically applicable. Functional categories should be conceptually clear, operationally meaningful and sufficiently flexible to support comparative research, airport planning and strategic analysis across different aviation systems.

Collectively, these principles define the methodological design requirements for the functional airport classification developed in the following chapter.

3.8 Summary

This chapter compared the systems reviewed in Chapter 2 through four dimensions: classification objectives, objects, criteria and practical applicability. The comparison showed that their differences reflect distinct institutional and analytical purposes rather than alternative versions of a single classification logic.

Across these approaches, no single framework provides an internationally applicable classification centred primarily on airport function. This is the research gap addressed by the functional framework developed in the following chapters.

The comparison also established five design requirements for that framework: international applicability, functional orientation, compatibility with existing systems, recognition of changing airport roles and practical usability.

These requirements form the methodological basis for the conceptual framework developed in Chapter 4.

Chapter 4

Conceptual Framework for Functional Airport Classification

4.1 Introduction

Chapter 3 established the need for an internationally applicable framework focused specifically on airport function and identified the methodological requirements such a framework should satisfy.

This chapter turns from comparison to construction. It develops the concepts needed to describe airport function consistently while remaining compatible with established technical, regulatory, administrative and statistical classifications.

The development of such a framework requires a clear understanding of what constitutes an Airport Function and how multiple functions coexist within a single airport. Modern airports rarely serve a single functional purpose. Most simultaneously support passenger transport, cargo operations, general aviation, aircraft maintenance, flight training, emergency services and other specialised activities. These functions differ in their relative importance, operational significance and contribution to the airport's overall role within the air transport system.

Accordingly, this chapter introduces the conceptual foundations of functional airport classification. It first defines the concept of an Airport Function and distinguishes it from related concepts such as airport activity, airport operation, airport service and airport role. It then introduces the concepts of Primary Airport Function and Secondary Airport Function, followed by the concept of the Airport Functional Profile, which constitutes the central analytical element of the proposed methodology. Together, these concepts establish the conceptual framework upon which the functional airport classification developed in the following chapter is constructed.

4.2 The Concept of Airport Function

Airport classification has traditionally relied on observable characteristics such as infrastructure, passenger traffic, aircraft movements, ownership or administrative status. These characteristics describe important properties of airports, yet they do not necessarily explain the purpose for which an airport exists within the air transport system. A functional classification therefore requires a different conceptual foundation centred on the notion of the Airport Function.

Although the term function is widely used in airport planning and transport literature, it is rarely defined explicitly. In many publications, it is used interchangeably with related concepts such as role, activity, operation or service, despite the fact that these terms describe different aspects of airport performance. This lack of conceptual distinction complicates the development of a consistent functional classification.

From a systems perspective, a function represents the purpose or contribution of an element within a larger system. Applied to airports, an Airport Function expresses the principal contribution that an airport makes to the operation and development of the air transport system rather than the individual activities carried out within the airport itself. Passenger transport, cargo distribution, regional accessibility or aviation support therefore represent Airport Functions, whereas passenger processing, aircraft handling, aircraft maintenance or flight instruction constitute operational activities through which those functions are performed.

For the purposes of the proposed methodology, it is necessary to distinguish several closely related concepts.

An airport activity is a specific operational or organisational activity undertaken by airport stakeholders, such as passenger processing, cargo handling, aircraft maintenance or commercial operations.

An airport operation is an organised operational process performed within the airport environment, including aircraft movements, ground handling, air traffic support or airside operations.

An airport service is a service provided by the airport to airlines, passengers, cargo operators or other aviation stakeholders.

An airport role describes the functional position occupied by an airport within the air transport system or network, for example as a hub, gateway, regional airport or feeder airport.

An Airport Function, by contrast, expresses the fundamental purpose fulfilled by an airport within the broader air transport system. Unlike activities, operations, services or roles, Airport Functions describe why an airport exists rather than how it performs its daily operations.

Accordingly, the following definition is proposed for the purposes of this monograph:

Airport Function is the fundamental purpose fulfilled by an airport within the air transport system, expressed through its principal contribution to the movement of passengers, cargo, aircraft or other aviation services, irrespective of its ownership, infrastructure or administrative status.

This definition is proposed specifically for the functional classification developed in this monograph. It establishes the conceptual basis for the methodology presented in the following sections by defining the Airport Function as the principal object of functional analysis.

4.2.1 Primary and Secondary Airport Functions

The definition of an Airport Function establishes the conceptual basis for functional classification. It does not imply, however, that every airport performs only a single function. On the contrary, contemporary airports typically support a broad range of aviation and non-aviation activities that collectively contribute to the operation of the air transport system.

These activities correspond to multiple Airport Functions that differ in their strategic significance, operational importance and contribution to the airport's overall purpose. Consequently, a distinction should be made between Primary Airport Functions and Secondary Airport Functions.

A Primary Airport Function is the dominant function that defines the principal purpose of an airport within the air transport system. It represents the function for which the airport is primarily developed, recognised and utilised, and therefore provides the principal basis for functional classification.

A Secondary Airport Function is any additional function that supports, complements or extends the Primary Airport Function without defining the airport's principal identity within the air transport system.

The distinction between Primary and Secondary Airport Functions reflects the evolutionary nature of airports. An airport originally developed to support passenger transport may subsequently become an important cargo centre, maintenance base or general aviation facility. Likewise, airports established for military or industrial purposes may gradually acquire significant civil aviation functions. As airport activities diversify, their functional composition becomes increasingly complex.

The Primary Airport Function should therefore not be regarded as immutable. It may change over time in response to airport development, transportation demand, airline strategies, technological innovation or public policy. Functional classification should reflect these long-term changes while remaining sufficiently stable to avoid unnecessary reclassification resulting from temporary operational fluctuations.

The distinction between Primary and Secondary Airport Functions does not imply that secondary functions are less important. In many cases, they may generate substantial traffic, economic value or strategic significance. Rather, the distinction recognises that airports generally possess one dominant function that determines their principal role within the air transport system, while additional functions contribute to functional diversity and long-term development.

This conceptual distinction provides a practical mechanism for describing airports without creating separate classification categories for every possible combination of functions. Instead, the proposed framework identifies a dominant function while preserving complementary functions within a structured functional description.

4.2.2 Multifunctional Airports

Historically, airports were frequently associated with a single dominant purpose, such as passenger transportation, military aviation or flight training. The continued development of air transport, airport commercialisation and the diversification of aviation services have fundamentally changed this pattern. Contemporary airports increasingly perform multiple Airport Functions simultaneously, combining transportation, logistics, commercial, technical and public-service activities within a single operational system.

Major international airports commonly integrate passenger transport, cargo operations, aircraft maintenance, business aviation, emergency services and commercial activities. Regional airports often combine scheduled passenger services with general aviation, flight training and aerial work. Even relatively specialised airports frequently support complementary activities that extend beyond their original purpose.

As a result, modern airports should generally be regarded as multifunctional systems rather than facilities dedicated to a single operational objective.

Multifunctionality presents an important methodological challenge for airport classification. If every combination of Airport Functions were treated as a separate airport type, the number of possible classification categories would increase rapidly, reducing both conceptual clarity and practical applicability.

The distinction between Primary and Secondary Airport Functions provides an effective solution to this challenge. Every airport may perform several functions simultaneously, yet one function generally remains dominant in defining its principal contribution to the air transport system. Secondary functions describe additional operational capabilities and specialisations without altering the airport's Primary Airport Function.

Consequently, the proposed classification treats multifunctionality not as an exception but as a normal characteristic of contemporary airports. Functional diversity is recognised through the structured representation of Airport Functions rather than through the creation of numerous hybrid categories. This representation forms the basis for the Airport Functional Profile introduced in the following section.

4.3 Airport Functional Profile

The concepts of Primary Airport Function and Secondary Airport Function provide the theoretical foundation for describing the functional characteristics of an airport. However, neither concept alone is sufficient to represent the complexity of contemporary airports. Most airports perform several functions simultaneously, and their operational identity is determined not by a single function but by the combination of functions they perform within the air transport system.

To capture this complexity, the present study introduces the concept of the Airport Functional Profile.

Airport Functional Profile is defined as the structured and systematic representation of all Airport Functions performed by an airport at a given stage of its development, including the identification of its Primary Airport Function and all relevant Secondary Airport Functions.

This definition is proposed specifically for the methodology developed in this monograph. The Airport Functional Profile constitutes the primary analytical unit of the proposed functional classification framework.

Unlike existing airport classifications, which typically describe airports through infrastructure, traffic volume, ownership, administrative status or network position, the Airport Functional Profile focuses on the airport's functional composition. It identifies not only the dominant function that characterises

the airport's principal purpose but also the complementary functions that contribute to its operational capabilities, strategic importance and long-term development.

The Airport Functional Profile therefore provides a more comprehensive representation of airport functionality than a single functional category. While the Primary Airport Function establishes the airport's principal functional identity, Secondary Airport Functions describe the airport's functional diversity and explain how it simultaneously supports different components of the air transport system.

An important characteristic of the Airport Functional Profile is its dynamic nature. Airport Functions evolve in response to changes in airline business models, transportation demand, regional economic development, technological innovation and public policy. Consequently, the Airport Functional Profile may change over time without corresponding changes in the airport's physical infrastructure, ownership or administrative status. A passenger airport may gradually develop into a significant cargo centre; a regional airport may become an important general aviation or training facility; and military airports may progressively acquire civil aviation functions. The Airport Functional Profile therefore represents the functional state of an airport at a particular stage of its development rather than a permanent characteristic.

The proposed concept also provides a practical solution to the methodological challenge of multifunctionality. Instead of creating separate classification categories for every possible combination of Airport Functions, the Airport Functional Profile records the complete functional composition of an airport while preserving a clear and consistent basis for classification. In this way, multifunctionality is recognised as an inherent characteristic of modern airports rather than as an exception requiring special classification rules.

The Airport Functional Profile should therefore be regarded as a descriptive concept rather than a classification category. Its purpose is to describe the complete functional composition of an airport by identifying both its Primary Airport Function and its Secondary Airport Functions.

By contrast, the Functional Airport Type represents the outcome of the classification process. It is determined by the Primary Airport Function identified within the Airport Functional Profile, while the Secondary Airport Functions provide additional information concerning the airport's operational diversity, functional specialisation and development potential.

This distinction is fundamental to the proposed framework. The Airport Functional Profile describes what functions an airport performs, whereas the Functional Airport Type identifies how the airport is classified. By explicitly separating functional description from functional classification, the proposed framework enables multifunctional airports to be represented consistently without generating an excessive number of hybrid classification categories.

Figure 4.1 illustrates the conceptual relationships among Airport Functions, the Airport Functional Profile and the resulting Functional Airport Type.

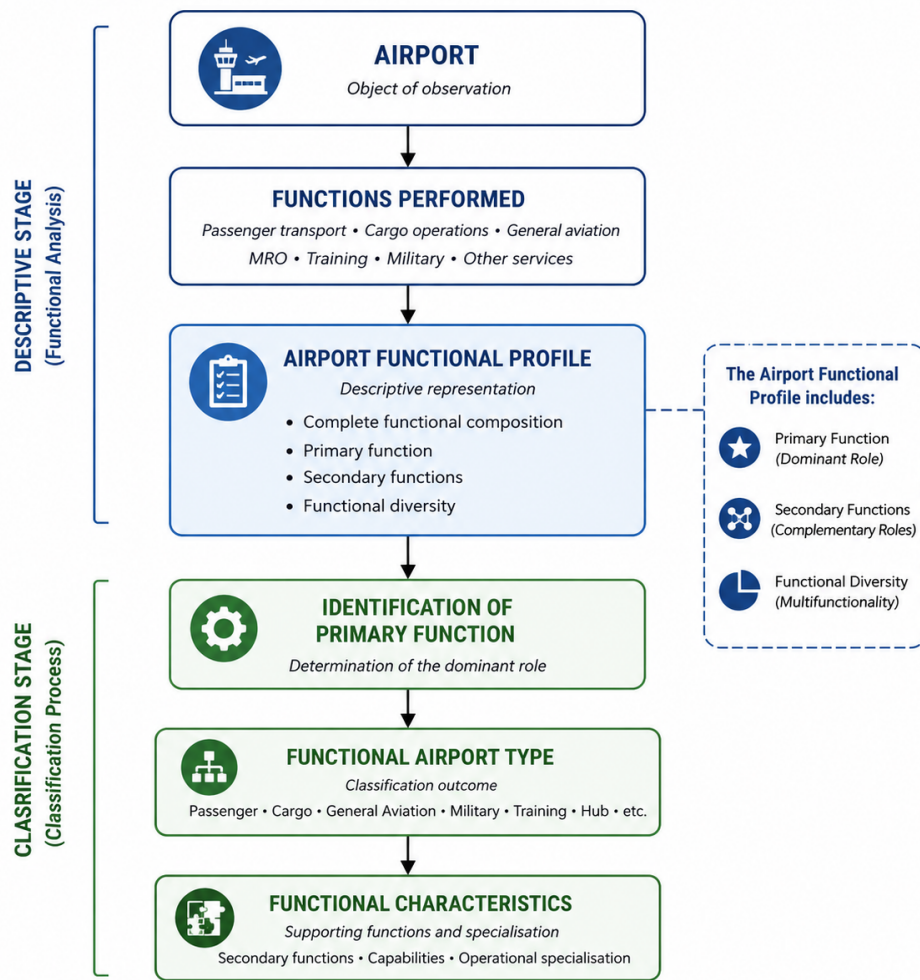


Figure 4.1. Conceptual framework of functional airport classification.

Within the proposed framework, the Airport Functional Profile constitutes the primary analytical unit of the methodology, whereas the Functional Airport Type constitutes the outcome of the classification process. The Airport Functional Profile provides the descriptive representation of airport functionality, while the Functional Airport Type provides its systematic classification according to the Primary Airport Function. This distinction establishes a clear separation between functional analysis and functional classification, forming the methodological foundation upon which the functional taxonomy developed in Chapter 5 is constructed.

4.4 Principles of Functional Classification

The introduction of the Airport Functional Profile establishes the conceptual basis of the proposed methodology. The next step is to define the principles governing the functional classification process. These principles ensure that the proposed framework remains scientifically consistent, practically applicable and fully compatible with existing airport classification systems.

Unlike conventional airport classifications, which are primarily based on infrastructure, traffic volume, ownership or administrative status, the proposed methodology classifies airports according to the functions they perform within the air transport system. The following principles therefore guide both the development and practical application of the functional classification framework.

Universality

The proposed methodology should be applicable to airports operating under different national regulatory systems, ownership structures and organisational models. Functional classification should there-

fore depend upon Airport Functions rather than country-specific legal or administrative arrangements. This principle enables airports from different regions of the world to be analysed within a common methodological framework.

Functional Orientation

The proposed methodology classifies airports according to what they do rather than what they possess. Infrastructure, passenger traffic, ownership and governance remain important airport characteristics, but they do not constitute the primary object of functional classification. Instead, classification is based on the Primary Airport Function identified within the Airport Functional Profile.

Recognition of Multifunctionality

Contemporary airports perform multiple Airport Functions simultaneously. Multifunctionality should therefore be regarded as a normal characteristic of modern airports rather than as an exceptional case. Instead of creating separate categories for every possible combination of functions, the proposed methodology identifies the Primary Airport Function while preserving all Secondary Airport Functions within the Airport Functional Profile.

Compatibility

The proposed methodology complements rather than replaces existing airport classification systems. International standards established by ICAO, operational classifications developed by IATA and ACI, and national regulatory classifications continue to fulfil their respective technical, operational and administrative purposes. Functional classification introduces an additional analytical perspective that can coexist with these established approaches without creating conceptual conflicts.

Dynamic Adaptability

Airport Functions evolve in response to changes in airline business models, transportation demand, regional economic development, technological innovation and public policy. The proposed methodology should therefore accommodate long-term changes in Airport Functional Profiles while maintaining a stable conceptual framework. Consequently, airports may change their Functional Airport Type as their Primary Airport Function evolves over time.

Practical Applicability

Finally, the methodology should remain sufficiently simple for practical implementation. Functional categories should be conceptually clear, operationally meaningful and suitable for comparative research, airport planning and strategic decision-making. The methodology should enable consistent classification without requiring excessive amounts of data or unnecessarily complex analytical procedures.

Collectively, these principles define the methodological foundation of the proposed functional classification. They establish the conditions under which Airport Functional Profiles can be analysed consistently and Functional Airport Types assigned objectively across different aviation systems.

4.5 Functional Classification Criteria

The principles presented in the previous section define the conceptual basis of the proposed methodology. Their practical implementation requires a set of classification criteria capable of identifying Functional Airport Types while preserving the descriptive richness of the Airport Functional Profile.

Unlike existing airport classification systems, which frequently rely on infrastructure characteristics, traffic volume or administrative status, the proposed methodology evaluates airports according to the Airport Functions they perform within the air transport system. Consequently, the classification criteria are intended to identify the Primary Airport Function rather than to measure airport size, capacity or organisational characteristics.

Five complementary criteria constitute the basis of the proposed methodology.

Primary Airport Function

The Primary Airport Function represents the principal criterion for functional classification. It identifies the dominant purpose fulfilled by an airport within the air transport system and therefore determines the corresponding Functional Airport Type.

The Primary Airport Function is not necessarily associated with the airport's largest infrastructure, highest passenger volume or greatest economic output. Instead, it reflects the airport's principal functional contribution to the aviation system. Consequently, airports possessing similar physical characteristics may belong to different Functional Airport Types if their Primary Airport Functions differ.

Secondary Airport Functions

Secondary Airport Functions describe the complementary roles performed alongside the Primary Airport Function. They do not determine the Functional Airport Type but provide additional information concerning the airport's functional diversity, operational specialisation and future development potential.

Recording Secondary Airport Functions enables multifunctional airports to be represented consistently while avoiding the creation of numerous hybrid classification categories.

Functional Significance

Not all Airport Functions contribute equally to airport identity. Some represent core functions essential to the airport's existence, whereas others provide supporting or specialised capabilities. Functional significance therefore evaluates the relative contribution of each identified Airport Function within the Airport Functional Profile.

The distinction between Primary and Secondary Airport Functions should consequently be based upon their functional significance rather than upon any single quantitative indicator. This approach ensures that the methodology remains applicable to airports of different sizes, ownership structures and operational models.

Temporal Stability

Airport Functions may evolve over time in response to changes in transportation demand, airline strategies, economic development or government policy. Nevertheless, temporary operational fluctuations should not automatically result in changes to the Functional Airport Type.

The proposed methodology therefore considers the temporal stability of Airport Functions. Classification should reflect sustained functional characteristics rather than short-term operational variations, thereby ensuring consistency and long-term applicability.

Functional Integration

The final criterion considers the extent to which different Airport Functions operate as components of a coherent operational system. Contemporary airports increasingly integrate passenger transport, cargo logistics, aircraft maintenance, business aviation, emergency response and commercial services into interconnected functional environments.

Recognition of this integration enhances the descriptive value of the Airport Functional Profile without altering the fundamental principle that Functional Airport Types are determined by the Primary Airport Function.

Table 4.1. Key elements of the conceptual framework.

Criterion	Purpose	Role in the methodology
Primary Airport Function	Identifies the dominant airport purpose	Determines the Functional Airport Type
Secondary Airport Functions	Describe complementary airport roles	Form the Airport Functional Profile
Functional Significance	Evaluates the relative importance of Airport Functions	Supports identification of the Primary Airport Function
Temporal Stability	Ensures long-term consistency of classification	Prevents unnecessary reclassification
Functional Integration	Describes interactions among Airport Functions	Complements the Airport Functional Profile

Table 4.1 demonstrates that the proposed methodology combines descriptive and classification elements within a single conceptual framework. The Airport Functional Profile provides a comprehensive description of airport functionality through the identification of Primary and Secondary Airport Functions, whereas the Functional Airport Type is derived from the Primary Airport Function identified using the proposed classification criteria. This distinction ensures that the methodology remains analytically comprehensive while preserving a clear, consistent and reproducible classification process.

4.6 Conceptual Framework

The concepts, principles and classification criteria developed in this chapter together establish a unified framework for functional airport classification. The proposed framework integrates the concepts of Airport Function, Airport Functional Profile and Functional Airport Type into a coherent methodology capable of describing and classifying airports according to the functions they perform within the air transport system.

The framework distinguishes between two conceptually separate but closely interconnected processes: functional analysis and functional classification.

Functional analysis identifies and describes all Airport Functions performed by an airport. The outcome of this process is the Airport Functional Profile, which provides a structured and systematic representation of the airport's complete functional composition through the identification of its Primary Airport Function and all relevant Secondary Airport Functions. Accordingly, the Airport Functional Profile constitutes the descriptive component of the proposed methodology.

Functional classification uses the Airport Functional Profile as the basis for determining the Functional Airport Type. By applying the classification criteria established in the previous section, the Primary Airport Function is identified and becomes the basis for assigning the airport to a specific functional category. The remaining Secondary Airport Functions continue to characterise the airport's operational diversity, functional specialisation and development potential without creating additional classification categories.

The explicit separation between functional analysis and functional classification represents the principal methodological contribution of the proposed framework. Existing airport classification systems generally combine the description of airport characteristics with the assignment of classification categories. In contrast, the proposed methodology first establishes a comprehensive functional description of the airport and only then derives its Functional Airport Type. This separation improves methodological transparency, facilitates consistent application of the classification and accommodates the multi-functional nature of contemporary airports.

The proposed framework also preserves full compatibility with existing international and national airport classification systems. Infrastructure standards, operational classifications and regulatory frame-

works continue to fulfil their respective technical, operational and administrative purposes, while the proposed methodology introduces an additional analytical perspective based on Airport Functions. Consequently, the functional classification should be regarded as complementary to existing approaches rather than as their replacement.

The conceptual relationships among the principal elements of the proposed methodology are illustrated in Figure 4.1, which serves as the reference model for the functional airport taxonomy developed in Chapter 5.

4.7 Summary

This chapter established the conceptual foundations of the functional airport classification proposed in this monograph. It defined the concept of the Airport Function, distinguished it from the related concepts of airport activity, airport operation, airport service and airport role, and demonstrated that contemporary airports should be regarded as multifunctional systems performing several complementary functions simultaneously.

To represent this complexity, the chapter introduced the concept of the Airport Functional Profile, defined as the structured and systematic representation of all Airport Functions performed by an airport, including the identification of its Primary Airport Function and all relevant Secondary Airport Functions. The Airport Functional Profile constitutes the primary analytical unit of the proposed methodology, whereas the Functional Airport Type represents the outcome of the classification process derived from the airport's Primary Airport Function.

The chapter further established the principles and classification criteria governing the proposed methodology and integrated them into a coherent conceptual framework. By explicitly separating functional analysis from functional classification, the proposed framework provides a transparent, consistent and internationally applicable approach to describing and classifying multifunctional airports while remaining fully compatible with existing technical, operational and regulatory classification systems.

The conceptual framework developed in this chapter provides the methodological foundation for the functional taxonomy of airports developed in Chapter 5. Building upon the Airport Functional Profile introduced here, the following chapter defines the Functional Airport Types and establishes the classification categories derived from the Primary Airport Functions performed by contemporary airports.

Chapter 5

Functional Taxonomy of Airports

5.1 Introduction

The conceptual framework developed in Chapter 4 provides the basis for constructing a functional taxonomy of airports. Its central premise is that airports should be classified according to their Primary Airport Function, while additional functions remain represented within the Airport Functional Profile.

Chapter 5 translates the conceptual framework into the Airport Functional Classification System (AFCS), a taxonomy of Functional Airport Types defined by dominant airport function. It adds a functional layer to established technical, regulatory and traffic-based classifications rather than attempting to replace them.

A type assignment identifies the Primary Airport Function; significant additional roles remain recorded as Secondary Airport Functions within the Airport Functional Profile.

The chapter presents the structure of the AFCS taxonomy, defines its principal Functional Airport Types and identifies reserved categories for future expansion. Detailed definitions, classification rules and implementation procedures are established separately in the Airport Functional Classification Standard (AFCS) [25] and are therefore not reproduced here.

5.2 Development of the Functional Taxonomy

The functional taxonomy is derived from the distinction established in Chapter 4 between an airport's complete functional profile and its dominant function. Its objective is to provide a limited number of categories broad enough for international application while distinguishing major differences in the functions performed by airports.

Three considerations guide the taxonomy. First, each Functional Airport Type should represent a distinct functional position within the air transport system rather than merely a difference in airport size, infrastructure or traffic volume. Second, the types should be applicable across different national and regional aviation systems. Third, the taxonomy should accommodate airport multifunctionality without creating a separate category for every possible combination of functions.

On this basis, AFCS distinguishes seven Functional Airport Types applied to the present ≥ 1 million-passenger commercial-airport dataset: Global Hub (GHB), National Hub (NHB), Tourist Gateway (TGW), Capital Airport (CAP), Regional Airport (REG), Island Airport (ISL), and Cargo Airport (CGO). The broader taxonomy is extensible beyond this core empirical population.

The seven types capture different forms of functional dominance: network redistribution for hubs, destination access for Tourist Gateways, capital-serving connectivity for Capital Airports, territorial connectivity for Regional and Island Airports, and freight and logistics dominance for Cargo Airports.

They are not levels in a hierarchy of airport importance, nor are they traffic bands. Airports of similar size may therefore belong to different AFCS types when their dominant roles differ.

Beyond the seven types applied to the core commercial-airport dataset, AFCS recognises General Aviation Airport (GEN) as a Primary Functional Type when general or business aviation is functionally dominant. Military Airport (MIL) and Heliport (HEL) remain reserved for broader empirical application. Seaplane Airport (SEA) is treated differently: it is a specialised functional subtype rather than a separate Primary Functional Airport Type, because water-based operation describes the specialised form through which an underlying airport function is performed.

The taxonomy combines mutually exclusive Primary Functional Airport Types with controlled mechanisms for extension. Seven types are applied to the present ≥ 1 million-passenger commercial-airport

dataset; GEN may be used as a Primary Functional Type outside that core dataset, MIL and HEL remain reserved, and SEA is a supplementary subtype presently associated with REG where scheduled passenger connectivity is structurally dependent on seaplane operations. The examples in the following sections are illustrative rather than normative; detailed criteria, priority rules and implementation procedures are specified in the separate AFCS Standard [25].

5.3 Global Hub

A Global Hub (GHB) is an airport whose Primary Airport Function is to provide large-scale international and intercontinental connectivity through the concentration and redistribution of passenger flows. Its defining role is not simply high traffic volume or extensive international service, but its position as a major connecting node within the global air transport network.

The functional significance of a Global Hub derives from the combination of broad geographic connectivity and substantial transfer activity. Such airports typically connect multiple world regions and support airline networks in which a significant proportion of passengers travel through the airport rather than begin or end their journeys there. The distinction between traffic generation and connectivity is particularly important in identifying airport hub functions, since passenger volume alone does not adequately characterise an airport's position within the network [22].

Global Hubs are commonly associated with major network carriers and airline alliances, although the presence of a large airline base is not sufficient to determine this type. Similarly, extensive international traffic does not independently establish global hub status where origin-and-destination traffic remains dominant.

What distinguishes a Global Hub from other large international airports is primarily the scale, structure and geographic reach of its connecting function. Global Hubs occupy a structurally important position within international aviation networks by linking passenger flows across countries, regions and continents.

Examples are Dubai International Airport (DXB), Hamad International Airport (DOH), London Heathrow Airport (LHR), Frankfurt Airport (FRA) and Singapore Changi Airport (SIN), all of which combine broad international reach with a substantial connecting function.

5.4 National Hub

A National Hub (NHB) is an airport whose Primary Airport Function is to organise and redistribute passenger flows principally within a national or major subnational air transport system. It serves as a principal connecting node linking regional markets with major domestic destinations and, in many cases, with international services.

The functional basis of a National Hub is its connecting role within a geographically bounded aviation system. Unlike a Global Hub, its dominant network function does not depend on extensive intercontinental transfer flows. Its importance derives from its position within the national or major subnational network and its ability to concentrate and redistribute traffic between different regions and markets.

National Hubs may handle substantial international traffic and frequently serve as major bases for network airlines. International connectivity, however, does not by itself transform a National Hub into a Global Hub. Classification depends on the structure and geographic reach of connecting flows and on whether the airport's dominant network function primarily structures a national or major subnational aviation system or forms part of a major global connecting network.

Among the clearest examples are Helsinki Airport (HEL), Warsaw Chopin Airport (WAW), Oslo Airport (OSL), Lisbon Airport (LIS) and Auckland Airport (AKL): each performs a major connecting role within its national aviation system while also offering substantial international connectivity.

The distinction between Global and National Hubs is therefore based primarily on the scale, structure and geographic reach of the airport's connecting function rather than airport size. Both types perform a hub function, but Global Hubs organise passenger flows across major international and interconti-

mental networks, whereas National Hubs primarily structure connectivity within national or major subnational aviation systems. Detailed criteria for resolving borderline cases are specified in the AFCS Standard.

5.5 Tourist Gateway

A Tourist Gateway (TGW) is an airport whose Primary Airport Function is to provide air access to a major tourism destination or tourism-oriented region. Its functional identity is determined by the dominant role of tourism and leisure travel in shaping passenger demand, route structure and airport activity.

Tourist Gateways typically serve destinations characterised by substantial inbound leisure traffic and strong dependence on air transport for visitor access. Their networks may include scheduled, charter and seasonal services and may exhibit significant variations in traffic volumes according to tourism cycles. The defining factor, however, is not seasonality itself but the dominant relationship between airport activity and visitor demand at the destination.

The Tourist Gateway type is therefore determined by functional dependence on tourism rather than passenger volume or the proportion of international traffic. Large Tourist Gateways may handle substantial year-round traffic and extensive international networks, while smaller airports may exhibit stronger seasonal patterns.

Tourist Gateways may also perform important regional, national or connecting functions. These remain part of the Airport Functional Profile but do not alter the Functional Airport Type where tourism is functionally dominant.

Typical cases include Cancún International Airport (CUN), Antalya Airport (AYT), Harry Reid International Airport (LAS), Orlando International Airport (MCO), Phuket International Airport (HKT) and I Gusti Ngurah Rai International Airport (DPS), where tourism and leisure travel are central to the airport's functional role.

5.6 Capital Airport

A Capital Airport (CAP) is an airport whose Primary Airport Function is to provide air connectivity associated with the governmental and administrative role of a national capital. The type applies where this capital-serving function is more significant in defining the airport's role than a dominant global hub, national hub or other specialised function.

Capital Airports typically provide domestic and international connectivity supporting the concentration of national government institutions, diplomatic activity and related capital-city functions. They may also serve as important national gateways. However, location in or near a national capital does not by itself determine classification as a Capital Airport.

Where a capital-city airport performs a stronger Global Hub, National Hub or other specialised function, that dominant function determines its Functional Airport Type, while the capital-serving role remains part of its Airport Functional Profile. CAP is therefore particularly relevant where an airport's functional significance cannot be adequately explained by traffic volume or network centrality alone.

Bucharest Henri Coandă International Airport (OTP), Tbilisi International Airport (TBS), Tirana International Airport (TIA) and Chişinău International Airport (RMO) illustrate the CAP type: in each case, serving the national capital is a defining role not superseded by a dominant global or national hub function.

The distinction between Tourist Gateways and Capital Airports further illustrates the principle of functional dominance within AFCS. Tourist Gateways are principally shaped by tourism-oriented access, whereas Capital Airports are shaped by connectivity associated with the governmental and administrative functions of national capitals. Detailed rules for resolving competing functional characteristics are specified in the AFCS Standard.

5.7 Regional Airport

A Regional Airport (REG) is an airport whose Primary Airport Function is to provide direct air connectivity between a regional or local market and the wider national or international air transport system. It represents the broadest applied functional category within AFCS and reflects the role of airports in connecting regional communities and economies with wider air transport networks.

The REG category is independent of traffic volume and may therefore include both large regional airports and small commercial airports whose principal function is to connect regional or local markets with the wider air transport system.

Regional Airports may serve metropolitan areas, secondary cities or wider regional territories and may support both domestic and international services. Their route networks are generally oriented towards origin-and-destination traffic, although connecting activity may also occur. The defining factor is not airport size or geographic location but the predominance of the regional connectivity function. The role of regional airports in providing territorial accessibility and connectivity has also been recognised in regional air transport research [26].

The category consequently encompasses airports with substantially different traffic volumes and network structures. Some Regional Airports primarily provide domestic connectivity, while others maintain extensive international networks. High passenger traffic or a substantial international network therefore does not by itself exclude an airport from the REG category.

The regional connectivity function is dominant where no specialised hub, tourism, capital, island-connectivity or cargo function more accurately characterises the airport's principal role. Regional Airports may nevertheless support tourism, cargo, general aviation and other Secondary Airport Functions, which remain represented within the Airport Functional Profile.

Airports illustrating this role include Birmingham Airport (BHX), Stuttgart Airport (STR), Toulouse–Blagnac Airport (TLS), Sacramento International Airport (SMF) and Fukuoka Airport (FUK). Their principal role is connectivity for major regional markets rather than one of the more specialised functions represented elsewhere in the taxonomy.

5.8 Island Airport

An Island Airport (ISL) is an airport whose Primary Airport Function is to provide a structurally important external air-connectivity function for an island or island community. Its functional identity derives from the particular importance of aviation in overcoming geographic separation and maintaining access to wider national and international transport networks.

Classification as ISL depends on connectivity dependence rather than island location alone. Many major airports are geographically located on islands but perform functions more appropriately represented by other AFCS categories. Airports serving major hubs, metropolitan areas or tourism destinations are not classified as ISL where those functions dominate their Airport Functional Profiles.

The significance of air connectivity should be considered in relation to the availability and practical importance of alternative transport links. Where surface connections are absent, limited or comparatively constrained, aviation may assume a particularly important role in connecting residents, visitors, public services and economic activity with external markets. The functional significance of an Island Airport may therefore be substantially greater than its passenger volume alone would suggest.

The distinction between an Island Airport and a Tourist Gateway requires particular attention because island economies frequently depend heavily on tourism. Where tourism demand constitutes the dominant reason for airport activity, TGW classification is appropriate. Where the airport's principal role is maintaining external connectivity for the island community, ISL provides the more accurate Functional Airport Type.

The type is illustrated by Jersey Airport (JER), Guernsey Airport (GCI), Isle of Man Airport (IOM) and, outside the British Isles, Faa'a International Airport (PPT) in French Polynesia. In each case, air transport performs a structurally important external-connectivity function for an island community.

The distinction between Regional and Island Airports similarly depends on functional context rather than geography. Both types may primarily provide origin-and-destination connectivity, but an Island Airport is distinguished by the structural importance of air access to the territory it serves. Detailed classification criteria and rules for borderline cases are provided in the AFCS Standard [25].

The connectivity-dependence principle underlying ISL may also have a broader geographical application. An island airport can be understood as one specific form of an accessibility-dependent airport, but comparable functions occur in non-island remote regions where permanent surface access is absent, highly constrained or seasonal. Deering Airport (DRG) and Stebbins Airport (WBB) in Alaska provide illustrative mainland examples of communities that depend heavily on year-round air access. A comparable Russian case is Vanavara Airport (VAQ) in Evenkia, Krasnoyarsk Krai: aviation is the settlement's only year-round mode of transport, while scheduled air services connect Vanavara with Krasnoyarsk and remote settlements across Evenkia. Whether such airports should remain within REG or eventually form a distinct Remote Airport (REM) type requires further empirical research and is not resolved in the present taxonomy.

5.9 Cargo Airport

A Cargo Airport (CGO) is an airport whose Primary Airport Function is the movement, handling and distribution of air freight. Its functional identity is determined by the dominant role of cargo and logistics activities within the airport's overall operations rather than by cargo volume alone.

Cargo Airports typically support concentrated freight operations, express and integrator networks, specialised logistics facilities or major air-cargo distribution activities. Their operating patterns and infrastructure may reflect the requirements of freight transport, including dedicated freighter operations, cargo terminals, warehousing and logistics facilities. These characteristics provide evidence of the cargo function but do not independently determine CGO classification.

Central to the CGO type is the functional dominance of cargo activity. Many major passenger airports handle substantial quantities of air freight, particularly Global and National Hubs, but this does not make them Cargo Airports where passenger connectivity remains their Primary Airport Function. Conversely, an airport may qualify as CGO even where its total traffic is lower than that of major passenger hubs if freight and logistics constitute its dominant purpose within the air transport system.

Cargo Airports may also handle scheduled passenger services and perform other Secondary Airport Functions. Such activities remain part of the Airport Functional Profile but do not alter the Functional Airport Type where the cargo function remains dominant.

Examples include Memphis International Airport (MEM), Louisville Muhammad Ali International Airport (SDF), Cincinnati/Northern Kentucky International Airport (CVG) and East Midlands Airport (EMA), where freight, express logistics or dedicated cargo operations are central to the airport's functional identity.

The distinction between Cargo Airports and passenger-oriented hubs is therefore based on the dominant function rather than the absolute scale of cargo activity. Detailed criteria for determining cargo dominance are specified in the AFCS Standard.

5.10 Specialised and Reserved Categories

The seven Functional Airport Types described above form the applied core used for the present ≥ 1 million-passenger commercial-airport dataset. AFCS also recognises specialised facilities outside this core population. General Aviation Airport (GEN) is treated as a functional type where general or business aviation is dominant; Military Airport (MIL) remains a reserved functional type. Heliport (HEL) remains reserved, while Seaplane Airport (SEA) is treated as a specialised functional subtype rather than a separate Primary Functional Airport Type.

This distinction preserves the single-label principle of AFCS. GEN and MIL describe what an airport primarily does and can therefore operate as Primary Functional Types when the relevant airport population is analysed. By contrast, SEA describes a specialised operating form that may coexist with an

underlying functional role. In the present application, scheduled passenger seaplane facilities are therefore classified by their Primary Airport Function and may additionally receive the SEA subtype.

5.10.1 Military Airport

A Military Airport (MIL) is an airport whose Primary Airport Function is to support military aviation operations, including transport, training, surveillance, combat and other defence-related activities.

Military use alone does not determine MIL classification. Civil airports accommodating occasional or shared military operations retain another Functional Airport Type where civil aviation remains functionally dominant.

Ramstein Air Base (RMS), RAF Brize Norton (BZZ) and Edwards Air Force Base (EDW) are examples in which military aviation is the dominant airport function.

5.10.2 General Aviation Airport

A General Aviation Airport (GEN) is an airport whose Primary Airport Function is to support general aviation rather than scheduled passenger or cargo transportation. Its activities may include business aviation, private flying, flight training and other non-airline operations.

General aviation activity at a major commercial airport is treated as a Secondary Airport Function where scheduled passenger, cargo or another AFCS function remains dominant.

Van Nuys Airport (VNY), Teterboro Airport (TEB) and Paris–Le Bourget Airport (LBG) provide familiar examples. In the supplementary analysis of airports within multi-airport systems but outside the ≥ 1 million-passenger core dataset, GEN is also applied to Jacarepaguá–Roberto Marinho (RRJ), Nairobi Wilson (WIL), Eros (ERS), Seletar (XSP) and Colombo Ratmalana (RML), where general, business, charter or other non-core airline activity provides the dominant functional orientation.

5.10.3 Heliport

A Heliport (HEL) is retained as a reserved AFCS category for aviation facilities principally dedicated to helicopter operations. Because such facilities may perform substantially different underlying functions—including business, offshore, emergency and public-service aviation—HEL is not presently treated as an applied Functional Airport Type.

London Heliport and dedicated offshore heliports illustrate facilities in which helicopter operations define the character of the aviation facility.

5.10.4 Seaplane Airport Subtype

A Seaplane Airport (SEA) is a specialised AFCS functional subtype applied where an airport's scheduled or systematic passenger function is structurally dependent on seaplane operations and a water aerodrome. SEA does not replace the Primary Functional Airport Type. Instead, it records a specialised operating form beneath the primary classification; in the present application it is used as a subtype of Regional Airport (REG).

Classification as SEA requires more than the presence of seaplane activity. The facility should operate as a water aerodrome or seaplane base, support systematic or scheduled passenger services, use seaplane operations as its principal passenger operating form, and derive a material part of its network or market-access role from this specialisation. Vancouver Harbour (CXH), Kenmore Air Harbor (KEH) and Seattle Lake Union (LKE) provide examples of REG airports with the SEA subtype. Their separate roles within multi-airport systems remain represented through Airport System Role.

5.11 Structure of the AFCS Taxonomy

The Airport Functional Classification System retains seven applied Primary Functional Airport Types for the ≥ 1 million-passenger commercial-airport dataset. GEN may be applied as a Primary Functional Type when the empirical scope is extended to general-aviation-dominant facilities, while MIL and HEL remain reserved for broader application. SEA is represented separately as a specialised functional subtype and therefore does not expand the number of mutually exclusive Primary Functional Airport Types.

Table 5.1. Structure of the Airport Functional Classification System

Code	Type / Category	Principal Functional Basis	Status
GHB	Global Hub	Global and intercontinental connecting function	Applied
NHB	National Hub	National or major subnational connecting function	Applied
TGW	Tourist Gateway	Access to major tourism destinations	Applied
CAP	Capital Airport	National capital connectivity	Applied
REG	Regional Airport	Regional and local connectivity with wider air transport networks	Applied
ISL	Island Airport	Structurally important external connectivity for an island territory	Applied
CGO	Cargo Airport	Air freight and logistics function	Applied
MIL	Military Airport	Military aviation operations	Reserved functional type
GEN	General Aviation Airport	General and business aviation operations	Applied outside core dataset
HEL	Heliport	Helicopter-based aviation facility	Reserved category
SEA	Seaplane Airport	Specialised water-aerodrome passenger operating form under REG	Applied functional subtype

The taxonomy is based on functional differentiation rather than a hierarchy of airport importance. The applied types are neither ranked nor determined by airport size or traffic volume. Each represents a distinct Primary Airport Function, while additional functions remain represented within the Airport Functional Profile.

The distinction between the core commercial-airport application, specialised extensions and reserved categories reflects empirical scope rather than a hierarchy of importance. GEN can be applied directly where general aviation is functionally dominant. SEA is supplementary because water-based operation describes how a passenger-connectivity function is performed rather than, by itself, what primary function the airport performs.

The structure presented in Table 5.1 is therefore intended to be extensible while preserving the single Primary Airport Function. Functional subtypes provide a controlled mechanism for representing structurally important specialisations without creating new primary types whenever a distinctive operating form is encountered. Detailed definitions and implementation rules are provided in the AFCS Standard.

5.12 Airport System Role in Multi-Airport Systems

The functional taxonomy does not, however, describe every aspect of an airport's position within the air transport system. Airports serving large metropolitan areas may form part of a multi-airport system

(MAS) in which two or more commercial airports participate in the same metropolitan air transport market. Within such systems, airports may perform different roles in relation to one another.

Airports such as London Stansted (STN), Milan Bergamo (BGY) and Paris Beauvais (BVA) are commonly regarded as secondary or alternative airports because they provide alternative access to metropolitan markets also served by other major airports. This characteristic does not constitute a separate Functional Airport Type within AFCS.

The distinction is methodological. Functional Airport Types describe the dominant function of the airport itself, whereas Airport System Role describes the airport's position in relation to other airports serving the same metropolitan market. Airport System Role is therefore a supplementary relational attribute rather than an additional level of the AFCS functional taxonomy. It is not an Airport Function and does not form part of the Airport Functional Profile as either a Primary or Secondary Airport Function.

For airports belonging to a recognised MAS, three Airport System Roles are distinguished:

Primary Metropolitan Gateway (PMG) — an airport performing a distinct and substantial primary role within the metropolitan airport system. More than one PMG may exist within the same system.

Alternative Metropolitan Gateway (AMG) — an airport whose position within the system is substantially defined by providing an alternative to one or more Primary Metropolitan Gateways.

Mixed System Role (MSR) — an airport combining a substantial independent local, regional, specialised or other function with an important alternative or complementary role within the metropolitan airport system.

Airport System Role applies only to airports belonging to a recognised MAS and is therefore not assigned to all airports. Neither airport size nor traffic volume determines the role. Geographic distance from the metropolitan centre and the concentration of low-cost traffic may provide relevant evidence, but neither is sufficient on its own. The determining consideration is the airport's relationship with the metropolitan air transport market and with the other airports serving that market.

For example, London Heathrow Airport (LHR), Gatwick Airport (LGW) and London City Airport (LCY) perform different but primary metropolitan roles, while Stansted Airport (STN) and Luton Airport (LTN) principally provide alternative access to the London market. In other systems, an airport may combine both characteristics. Baltimore/Washington International Airport (BWI), for example, performs an independent role for Baltimore while also serving the wider Washington metropolitan market, resulting in a Mixed System Role.

Determination of Airport System Role is separate from the AFCS procedure used to assess functional dominance and assign the Functional Airport Type. System Role does not enter the determination of Candidate Functions, the Primary Airport Function, or the decision and precedence rules used to resolve competing functions.

The concept therefore allows differences in metropolitan position to be represented without introducing the “secondary airport” as an additional Functional Airport Type. Functional Airport Type describes what an airport primarily does; Airport System Role describes how the airport is positioned within a multi-airport metropolitan system.

5.13 Summary

This chapter translated the conceptual framework established in Chapter 4 into the functional taxonomy of AFCS. The taxonomy identifies an airport's Primary Airport Function while retaining additional functions within the Airport Functional Profile. It is intentionally compact and does not create separate categories for every combination of airport functions.

The applied core of AFCS consists of seven Functional Airport Types: Global Hub, National Hub, Tourist Gateway, Capital Airport, Regional Airport, Island Airport and Cargo Airport. These types distinguish different forms of functional dominance without establishing a hierarchy based on airport size, traffic volume, infrastructure or economic importance.

AFCS also provides for extension beyond the current core dataset. General Aviation Airport (GEN) is applied as a Primary Functional Type outside that dataset; Military Airport (MIL) and Heliport (HEL) remain reserved for broader application; and Seaplane Airport (SEA) is an applied specialised functional subtype under Regional Airport (REG).

The chapter also distinguished Functional Airport Type from Airport System Role within multi-airport metropolitan systems. The latter represents a supplementary relational attribute and does not alter the functional taxonomy or the determination of an airport's Primary Airport Function.

Assignment of individual airports to these types requires a consistent methodology for evaluating functional evidence, determining functional dominance and resolving cases in which several functions compete for primary status. Chapter 6 therefore addresses the methodology for applying AFCS to individual airports, while detailed technical implementation rules remain specified separately in the AFCS Standard [25].

Chapter 6

Classification Methodology

6.1 Introduction

The functional taxonomy developed in Chapter 5 defines the principal airport types used within the Airport Functional Classification System (AFCS). Application of this taxonomy requires a consistent methodology for determining which function most accurately represents the role of an individual airport.

AFCS classification is based on the identification of an airport's Primary Airport Function rather than on a single quantitative indicator. Traffic, network, market, geographic and operational characteristics may provide evidence of airport function, but they must be interpreted in relation to the airport's wider role within the air transport system.

This chapter presents the general logic of the classification process. Detailed indicators, thresholds, precedence rules and implementation procedures are specified separately in the Airport Functional Classification Standard (AFCS) [25] and are therefore not reproduced here.

6.2 Classification Principle

The fundamental principle of AFCS is functional dominance. Each airport is assigned the Functional Airport Type corresponding to the function most strongly supported by the combined functional evidence.

Classification begins with functional evidence rather than with airport size or traffic volume. The evidence is used to construct the Airport Functional Profile and identify relevant Candidate Functions. These functions are then assessed to determine functional dominance. The dominant function is designated as the Primary Airport Function, while other significant functions remain Secondary Airport Functions.

This approach separates functional classification from airport scale. A large airport and a small airport may belong to the same Functional Airport Type if they perform essentially the same dominant function. Conversely, airports with similar passenger volumes may belong to different types where their roles within the air transport system differ substantially.

The classification process can therefore be expressed conceptually as:

Functional Evidence → Airport Functional Profile → Candidate Functions → Assessment of Functional Dominance → Primary Airport Function → Functional Airport Type

Where competing functions remain after the assessment of functional dominance, decision and precedence rules are applied to resolve the classification. These rules operate only after the relevant Candidate Functions have been established and do not replace functional assessment.

A conceptual overview of the classification process is presented in Figure 6.1.

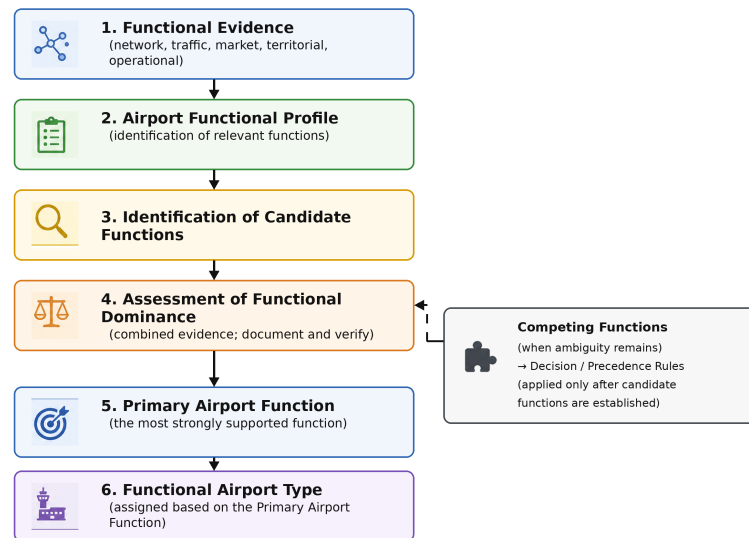
AFCS Classification Methodology (Conceptual Overview)

Figure 6.1. AFCS classification methodology (conceptual overview).

6.3 Functional Evidence

Determination of an airport's Primary Airport Function requires consideration of several forms of functional evidence. No single indicator is universally sufficient across all Functional Airport Types; classification is based on the combined interpretation of characteristics that describe the airport's role within the air transport system.

The principal forms of evidence include:

1. network evidence — route structure, geographic reach, connecting activity and the airport's position within airline networks;
2. traffic evidence — passenger and cargo volumes, traffic composition and the relative importance of different traffic segments;
3. market evidence — the principal sources and purposes of travel demand, including tourism and regional or capital-city demand;
4. geographic and territorial evidence — the characteristics of the territory served, including regional position, island geography and the availability of alternative transport connections;
5. operational evidence — the presence and relative importance of specialised passenger, cargo, general aviation or other aviation activities.

Individual indicators become functional evidence when interpreted in relation to the airport function being evaluated. For example, the number of international destinations is an indicator, whereas broad intercontinental network reach constitutes evidence supporting a global hub function. Similarly, cargo volume is an indicator, while the dominance of freight and logistics activity within the airport's overall role provides evidence supporting CGO classification.

The relative importance of different forms of evidence depends on the Functional Airport Type being evaluated; AFCS does not apply a universal weighting scheme across all airport functions. Network evidence is particularly important in distinguishing Global and National Hubs, market evidence in identifying Tourist Gateways, geographic and territorial evidence in assessing Island Airports, and cargo-related traffic and operational evidence in identifying Cargo Airports.

Quantitative indicators therefore provide evidence rather than predetermined classification outcomes. High passenger volume does not by itself identify a hub, substantial international traffic does not necessarily indicate a Global Hub, and large cargo throughput does not automatically establish a Cargo Airport. Where several functions are strongly represented, their relative functional significance must be evaluated before the Primary Airport Function is determined. Detailed indicators and evidence requirements are specified in the AFCS Standard.

6.4 Determination of the Primary Airport Function

The Primary Airport Function is determined by identifying which function is most strongly supported by the combined functional evidence. Candidate Functions identified within the Airport Functional Profile are evaluated in relation to the airport's network role, traffic structure, market orientation, geographic context and other relevant evidence.

A function is designated as primary where the evidence demonstrates its functional dominance relative to competing functions. Functional dominance does not necessarily imply numerical dominance in every indicator. An airport may, for example, perform a significant hub function even where transfer passengers do not constitute the majority of its total traffic. Similarly, tourism, capital-city connectivity or island accessibility may define an airport's role even where other traffic segments remain substantial.

Classification decisions should be based on documented and verifiable evidence. Where interpretation or judgement is required, the evidence supporting the assigned Primary Airport Function should be recorded so that the classification can be reviewed and reproduced. This is particularly important for borderline cases and comparative applications involving large airport datasets.

Once the Primary Airport Function has been established, the corresponding Functional Airport Type is assigned. Other significant functions remain recorded as Secondary Airport Functions within the Airport Functional Profile.

6.5 Resolution of Competing Functions

Many airports exhibit characteristics associated with more than one Functional Airport Type. A major tourism airport may also provide structurally important connectivity for an island community; a capital-city airport may perform a hub function; and a major passenger hub may simultaneously handle substantial cargo traffic.

Where one Candidate Function clearly dominates, the corresponding Functional Airport Type is assigned. Where competing functions remain after this assessment, AFCS applies decision and precedence rules to ensure consistent classification. Precedence rules are applied only after the relevant Candidate Functions have been established by functional evidence; they are not substitutes for functional assessment.

These rules are intended to resolve specific overlaps, including GHB/NHB, TGW/ISL, NHB/CAP and CGO/passenger-hub cases, where more than one function may plausibly qualify for primary status.

Precedence therefore serves as a classification mechanism rather than a ranking of functions. Priority assigned within a particular decision rule does not imply that one Functional Airport Type is inherently more important than another; it provides a consistent means of selecting the Primary Airport Function where competing functions cannot otherwise be resolved.

Detailed thresholds, precedence sequences and rules for borderline cases are specified in the AFCS Standard [25]. Their separation from the present chapter allows the general methodology to remain stable while technical parameters may be refined as AFCS is applied to broader airport populations.

6.6 Classification Output

The principal output of AFCS classification is the assignment of a single Functional Airport Type representing the airport's Primary Airport Function. This provides a standardised categorical result that can be used for comparison across airports, regions and aviation systems.

Secondary Airport Functions identified during the assessment remain associated with the classification result as part of the Airport Functional Profile. The assignment of a single primary type therefore does not replace or discard information about airport multifunctionality.

This distinction is particularly important when comparing airports assigned to the same Functional Airport Type. Such airports may differ substantially in traffic scale, geographic context and Secondary Airport Functions while sharing the same dominant functional role. AFCS provides comparability at the level of Primary Airport Function while the Airport Functional Profile preserves these additional differences.

AFCS classification is independent of the traffic or other quantitative thresholds used to define a particular research, ranking or analytical dataset. Dataset inclusion thresholds define the population analysed and do not constitute AFCS classification thresholds.

6.7 Summary

This chapter established the methodology for applying the AFCS taxonomy to individual airports. Functional evidence is used to construct the Airport Functional Profile, identify Candidate Functions and determine the Primary Airport Function through assessment of functional dominance. Different forms of evidence have different significance depending on the function being evaluated, and AFCS therefore does not apply a universal weighting scheme across all Functional Airport Types.

Where competing functions cannot be resolved through the initial assessment, decision and precedence rules provide a consistent classification mechanism. These rules are applied only after the relevant Candidate Functions have been established and do not constitute a hierarchy of airport types. Classification decisions should be supported by documented and verifiable evidence, allowing assignments to be reviewed and reproduced.

The resulting classification assigns a single Functional Airport Type while retaining significant Secondary Airport Functions within the Airport Functional Profile. Detailed indicators, thresholds, precedence rules and implementation procedures are specified separately in the AFCS Standard. Chapter 7 applies this methodology to a large international airport dataset and examines the resulting distribution of Functional Airport Types and selected classification cases.

Chapter 7

Empirical Validation and Application

7.1 Introduction

The practical applicability of a classification system depends on its ability to distinguish airport functions consistently across different geographic, market and operational contexts. AFCS was therefore applied to a large international dataset of commercial airports to evaluate the practical applicability of the taxonomy and classification methodology developed in Chapters 5 and 6.

The empirical application had three principal objectives: to assess whether the seven applied Functional Airport Types provide sufficient coverage of a large and diverse airport population; to examine the resulting distribution of airport types; and to identify cases in which competing functions require explicit resolution.

This chapter presents the principal results of the empirical application and validation. Detailed airport-level classifications and ranking results are published separately in the WAIS World Airports Ranking 2025 [27] and are not reproduced here.

7.2 Dataset and Selection Criteria

The empirical dataset comprises 951 commercial airports worldwide with at least 1 million passengers in 2025. This threshold provides a broad international dataset of commercially significant airports representing different regions, aviation markets and network structures.

The passenger threshold is a dataset selection criterion rather than an AFCS classification criterion. It determines which airports are included in the present empirical application but has no role in assigning Functional Airport Types. AFCS may therefore also be applied to airports below the one-million-passenger threshold, including smaller commercial airports whose dominant function may be regional connectivity, tourism access or island connectivity.

The dataset focuses on commercial airports and consequently does not provide systematic empirical coverage of military and general aviation airports, heliports or seaplane bases. These facilities remain outside the scope of the present empirical application.

Each airport was assessed according to the methodology described in Chapter 6 and the detailed classification rules specified in the AFCS Standard [25]. The complete airport-level dataset and associated results are published in the WAIS World Airports Ranking 2025 [27]; the present chapter reports only the aggregate results and selected classification cases required for empirical validation.

7.3 Application of AFCS to the Dataset

The AFCS methodology described in Chapter 6 was applied to each airport in the dataset. Each airport was assessed using the functional evidence and classification methodology described in Chapter 6 and the detailed rules specified in the AFCS Standard.

Where more than one functional interpretation was plausible, competing functions were explicitly reviewed and the Primary Airport Function was determined in accordance with the AFCS classification methodology.

All 951 airports received a Primary Airport Function within the seven applied Functional Airport Types: GHB, NHB, TGW, CAP, REG, ISL and CGO. Detailed airport-level classifications are presented separately in the WAIS World Airports Ranking 2025 [27].

7.4 Distribution of Functional Airport Types

Application of AFCS produced a strongly differentiated distribution across the seven Functional Airport Types. Regional Airports form the largest category, with 439 airports, followed by National Hubs

with 216 and Tourist Gateways with 169. Global Hubs account for 71 airports, while Capital Airports, Cargo Airports and Island Airports form substantially smaller groups. The resulting distribution is presented in Table 7.1.

Table 7.1. Distribution of Functional Airport Types in the 951-airport dataset

Functional Airport Type	Code	Airports	Share
Global Hub	GHB	71	7.5%
National Hub	NHB	216	22.7%
Tourist Gateway	TGW	169	17.8%
Capital Airport	CAP	38	4.0%
Regional Airport	REG	439	46.2%
Island Airport	ISL	8	0.8%
Cargo Airport	CGO	10	1.1%
Total	—	951	100.0%*

Percentages are rounded and may not sum exactly to 100.0%.

Source: WAIS World Airports Ranking 2025 [27]; AFCS classification dataset.

Of the 951 airports, 292 (30.7%) were identified during the classification review as having a plausible competing functional interpretation and therefore required explicit consideration of competing functions before final assignment. The remaining 659 airports (69.3%) did not require explicit competing-function resolution.

The distribution shows that almost half of the airports in the dataset perform a predominantly regional function, while National Hubs and Tourist Gateways also form substantial groups. ISL and CGO constitute the smallest groups in the present dataset, reflecting the relatively specialised functional roles represented by these types.

The results also illustrate why functional classification cannot be inferred from airport size alone. Airports with broadly comparable passenger volumes may perform different dominant roles and therefore belong to different Functional Airport Types.

7.5 Selected Classification Cases

A substantial minority of airports required explicit resolution of competing functions before final assignment. Table 7.2 presents selected cases illustrating different forms of functional overlap and their resolution.

These cases demonstrate that the presence of a particular characteristic does not by itself determine classification. Capital location, tourism activity, cargo traffic or island geography becomes decisive only where it represents the dominant airport function. Where competing interpretations remain, the decision and precedence rules described in Chapter 6 are applied; detailed criteria are specified in the AFCS Standard [25].

Table 7.2. Selected AFCS classification cases

Airport	Candidate Functions	Assigned Type	Principal Reason
Harry Reid International Airport (LAS)	TGW / NHB	TGW	Destination-oriented tourism and leisure demand is the dominant function.
Soekarno–Hatta International Airport (CGK)	NHB / CAP	NHB	Its national network and connecting role is more defining than its capital-city function.
Cancún International Airport (CUN)	TGW / NHB	TGW	Tourism-oriented destination traffic provides the dominant functional identity.
Ted Stevens Anchorage International Airport (ANC)	CGO / REG	CGO	Cargo and logistics activity constitutes the dominant functional role.
Memphis International Airport (MEM)	CGO / REG	CGO	Freight and express-logistics activity dominates the airport's regional passenger function.
Faa'a International Airport (PPT)	ISL / REG	ISL	External air connectivity is a defining transport function for the island territory.
La Tontouta International Airport (NOU)	ISL / REG	ISL	Island and territorial connectivity is more defining than a conventional regional-airport role.

7.6 Validation Results and Observations

The empirical application supports the practical applicability of the seven Functional Airport Types within the present dataset. All airports received a Primary Airport Function without requiring additional or hybrid Functional Airport Types.

The frequency of competing-function cases confirms that multifunctionality is a material characteristic of the airports examined, while their successful resolution supports the practical use of functional dominance and the associated decision and precedence rules.

The results also confirm that passenger scale alone does not adequately describe airport function. Airports of comparable scale may perform substantially different roles, and functional classification therefore provides information complementary to conventional traffic-based airport categories.

Within the present dataset, multifunctionality could be represented through the combination of a Primary Airport Function and significant Secondary Airport Functions within the Airport Functional Profile, without introducing hybrid types.

7.7 Scope and Limitations

The validation dataset provides broad international coverage of commercially significant airports, but its scope is defined by the selection criterion of at least 1 million passengers in 2025. The results therefore provide the strongest empirical support for application of AFCS to medium and large commercial airports.

The dataset does not systematically cover smaller commercial airports or specialised aviation facilities. This limitation should not be interpreted as restricting AFCS to airports above the dataset threshold. In particular, the REG type may also apply to smaller commercial airports whose dominant role is regional connectivity.

MIL and GEN remain outside the seven-type commercial-airport dataset examined in the present study. Heliports and seaplane bases are likewise outside the scope of the present empirical application.

The results should therefore be interpreted as validation of the practical applicability of AFCS within the scope of the present dataset, rather than as exhaustive validation across all classes of airports and aviation facilities. Future applications to smaller and specialised airports may extend the empirical scope of AFCS.

7.8 Summary

The empirical application supports the practical applicability of AFCS within the defined commercial-airport dataset. The seven applied Functional Airport Types provided sufficient coverage, while the functional-dominance methodology allowed competing airport roles to be resolved within a single primary classification.

Detailed airport-level classifications, comparative results and ranking data are presented separately in the WAIS World Airports Ranking 2025 [27].

Chapter 8

Applications and Future Development

8.1 Introduction

AFCS adds a functional dimension to airport analysis without turning function into a measure of performance. Having defined the taxonomy, methodology and empirical application in the preceding chapters, the discussion now turns to how the classification can be used and how it may develop.

Its practical value lies in distinguishing airports by the roles they perform within networks, markets and territories. That information can sharpen the interpretation of conventional indicators and help define comparison groups that are functionally meaningful.

The chapter also considers integration with the wider WAIS framework and the implications of applying AFCS to broader sets of airports and successive reference periods.

8.2 Functional Classification in Comparative Airport Analysis

Airport function and airport scale represent distinct analytical dimensions. Traffic indicators describe the scale of airport activity, while functional classification describes the role performed by the airport within the wider air transport system. Airports with similar passenger volumes may therefore perform substantially different functions, while airports assigned to the same Functional Airport Type may differ considerably in scale. Their relationship is summarised in Table 8.1.

Table 8.1. Functional classification and airport scale

Dimension	Describes	Typical Indicators
Functional Type	Role performed by the airport	Network role, market role, territorial function
Airport Scale	Size of airport activity	Passenger traffic, cargo volume, aircraft movements

For comparative work, Functional Airport Type can serve as an initial peer-group filter. Traffic scale, geography, market structure and other variables can then refine the comparison according to the question being asked.

A Regional Airport, for example, need not be evaluated against the same functional expectations as a Global Hub or Tourist Gateway solely because their traffic volumes are similar. Conversely, membership in the same Functional Airport Type does not imply that airports are otherwise equivalent; airports within a functional group may differ substantially in scale, geography, infrastructure, market structure and Secondary Airport Functions.

Functional Airport Types are not performance levels and do not rank airport importance. GHB, NHB, TGW and REG identify different dominant functions. Cross-type comparisons are still possible, but they should be interpreted with those functional differences in view.

8.3 Airport Research, Databases and Information Systems

In airport research, AFCS supplies a standardised functional attribute alongside traffic, geographic, infrastructure and operational variables. Datasets can therefore be filtered or grouped by dominant role as well as by size and location.

This is useful both for selecting plausible peer groups and for studying airports whose functions differ despite similar scale. If the methodology is held constant across successive reference periods, the same data structure can also be used to examine changes in airport roles over time.

In databases and information systems, the AFCS code can be stored as an additional categorical attribute linked to traffic, network, geographic and other airport data. It does not replace established identifiers or statistical variables, and Secondary Airport Functions can be retained where a single primary type is insufficient for the analytical task.

8.4 Airport Planning and Management

For planning, strategic analysis and benchmarking, the main contribution is contextual: AFCS helps identify airports that are plausible functional peers before more detailed comparison begins.

The same perspective is useful in network and market analysis, regional-accessibility studies and tourism-oriented airport development. It can also reveal a change in strategic role that would be obscured if traffic growth or decline were considered alone.

These uses do not alter the status of AFCS as an analytical classification. Regulatory, operational, infrastructure and planning classifications retain their own purposes; AFCS contributes a consistent description of airport function alongside them.

8.5 GIS and Digital Applications

In Geographic Information Systems (GIS) and other digital aviation platforms, Functional Airport Type can be treated as a standard categorical attribute and mapped directly to show the geographic distribution of airport functions.

Combined with spatial and network data, this supports analysis of regional accessibility, multi-airport systems and the geographic structure of air transport markets. Secondary Airport Functions add detail where multifunctionality matters, while standardised codes allow AFCS to sit alongside existing geographic, operational and statistical attributes.

8.6 Integration with WAIS

Within WAIS, AFCS serves as the airport functional-classification layer. Its codes can be combined with traffic, connectivity, geographic and other comparative indicators without merging those different analytical dimensions.

Airports can then be examined across the full dataset or within functional peer groups, giving quantitative comparisons an explicit functional context.

The WAIS World Airports Ranking 2025 [27] provides a large-scale application of this approach. AFCS classifications are incorporated into the airport dataset as a functional attribute, while the ranking and associated comparative indicators remain methodologically distinct from the classification itself. An airport's Functional Airport Type therefore provides context for comparative analysis but does not, by itself, determine its ranking position.

The distinction is deliberate: AFCS classifies airport function, whereas WAIS is the broader information and analytical framework in which that classification can be used.

8.7 Classification Stability and Future Development of AFCS

AFCS classification represents the functional role of an airport for a defined reference period. Although many airport functions remain stable over time, changes in airline networks, hub operations, tourism markets, cargo specialisation or territorial connectivity may justify reassessment of the Functional Airport Type. A change in classification should reflect a material change in airport function rather than short-term fluctuations in individual traffic indicators.

Longitudinal comparisons should apply a consistent classification methodology across reference periods so that observed changes reflect changes in airport function rather than changes in classification procedure.

The reserved MIL type and the broader application of GEN require further empirical testing. Supplementary analysis of airports within multi-airport systems but outside the core ≥ 1 million-passenger dataset provides an initial applied sample of GEN facilities. Seaplane facilities are treated through the SEA functional subtype where water-based scheduled passenger operations structurally define how a Regional Airport performs its connectivity function. Future scope expansion may further test HEL and additional specialised subtypes. The relationship between ISL and accessibility-dependent airports in remote non-island territories should also be examined in future work, including whether a distinct Remote Airport (REM) type is analytically justified or whether such cases are better represented within REG.

Continued application may support refinement of functional indicators, evidence requirements and decision rules. Such refinements should preserve the distinction between the core conceptual taxonomy and the more detailed technical criteria used to implement it. This allows AFCS to evolve as new evidence becomes available without requiring unnecessary changes to its underlying structure.

8.8 Summary

AFCS adds a functional dimension to established quantitative, operational and geographic airport information. In practice, that dimension can inform comparison, information systems, planning and the wider WAIS framework.

Its empirical basis can continue to grow. Individual classifications may change when airport roles change, and technical criteria can be refined as new cases and evidence become available.

Conclusion

Airports are routinely described through traffic, infrastructure, administrative status and operational parameters. Those dimensions are indispensable, but they do not answer a different question: what role does an airport primarily perform within the network, market and territory it serves? This study has developed and tested a systematic way of answering that question.

The review of existing systems showed why a separate functional perspective is useful. Regulatory, statistical, infrastructure and operational classifications remain necessary, yet their categories are designed for other purposes. Traffic scale is no substitute for function: airports of similar size may play different roles, and functionally similar airports may differ greatly in scale.

The resulting framework defines airport function as a dominant and sustained role within a network, market and territorial context. Classification rests on functional dominance rather than any single quantitative indicator, while the distinction between Primary and Secondary Airport Functions preserves the multifunctional character of real airports.

AFCS gives that framework an operational taxonomy. Each airport receives one Functional Airport Type corresponding to its Primary Airport Function; significant additional roles remain visible in the Airport Functional Profile as Secondary Airport Functions. This avoids a proliferation of hybrid categories while retaining information about multifunctionality.

The methodology then turns the taxonomy into a repeatable assessment process. Network, market, geographic and operational evidence is considered together, with decision and precedence rules used when competing interpretations remain plausible. Quantitative indicators can support the judgement, but they do not determine the type on their own.

Application to 951 commercial airports with at least 1 million passengers in 2025 provided a large-scale practical test. Every airport in the dataset could be assigned within the seven Functional Airport Types used for the commercial-airport study, while 292 airports (30.7%) required explicit resolution of competing functions. That proportion is itself instructive: multifunctionality is common enough that a classification system needs a transparent way to resolve it.

The results also reinforce the distinction between function and scale. AFCS types are neither traffic categories nor performance levels; they describe different dominant roles. Used in that way, they offer an additional basis for selecting peer groups and for interpreting differences that scale-based comparisons alone may hide.

Beyond classification itself, the functional layer can be used in comparative research, airport information systems, planning and digital applications. Within WAIS it can be combined with other aviation information while remaining separate from performance assessment and ranking.

AFCS is intended to evolve through application. A classification describes the dominant function for a defined reference period and may change when networks, markets or territorial connectivity change. Testing the framework on smaller commercial airports and specialised facilities will broaden its empirical basis and may refine technical criteria without altering the core conceptual distinction between taxonomy and implementation.

The broader contribution is to treat airport function as a distinct, systematically classifiable dimension of aviation analysis. AFCS complements rather than replaces regulatory, statistical, infrastructure and operational classifications because it addresses a different analytical problem.

By separating function from scale, performance and administrative status, it provides a common basis for describing and comparing the diverse roles of airports worldwide.

References

- [1] Ashford, N. J., Mumayiz, S. A., and Wright, P. H. *Airport Engineering: Planning, Design and Development of 21st Century Airports*. 4th ed. Wiley, 2011.
- [2] de Neufville, R., and Odoni, A. *Airport Systems: Planning, Design and Management*. 2nd ed. McGraw-Hill, 2013.
- [3] International Civil Aviation Organization (ICAO). *Annex 14 to the Convention on International Civil Aviation — Aerodromes. Volume I: Aerodrome Design and Operations*. 9th ed. Montreal: ICAO, 2022.
- [4] International Civil Aviation Organization (ICAO). *Procedures for Air Navigation Services — Aerodromes (PANS-Aerodromes)*, Doc 9981. 3rd ed. Montreal: ICAO, 2020, as amended.
- [5] International Civil Aviation Organization (ICAO). *Convention on International Civil Aviation (Chicago Convention)*. Chicago, 1944.
- [6] Airports Council International (ACI World). *2026 Airport Economics Report*. Montreal: ACI World, 2026.
- [7] International Air Transport Association (IATA). *Airport Development Reference Manual (ADRM)*. 12th ed. Montreal: IATA, 2022.
- [8] EUROCONTROL. *European Network Operations Plan 2025/2026–2029. Version 1*. Brussels: EUROCONTROL, 2025.
- [9] Federal Aviation Administration (FAA). *National Plan of Integrated Airport Systems (NPIAS), 2025–2029*. Washington, DC: FAA, 2024.
- [10] Federal Aviation Administration (FAA). *Order 5100.38D, Airport Improvement Program Handbook. Change 1*. Washington, DC: FAA, 2019.
- [11] Federal Aviation Administration (FAA). *Advisory Circular AC 150/5300-13B — Airport Design. Change 1*. Washington, DC: FAA, 2024; errata updated 2025.
- [12] National Development and Reform Commission of China and Civil Aviation Administration of China (CAAC). *National Civil Transport Airport Layout Plan [全国民用运输机场布局规划]*. NDRC Document No. 290, 2017.
- [13] Airports Authority of India (AAI). *Annual Report 2024–25*. New Delhi: Airports Authority of India, 2025.
- [14] Ministry of Civil Aviation, Government of India. *Regional Connectivity Scheme (RCS–UDAN). Version 4.0*. New Delhi: Ministry of Civil Aviation, 2019.
- [15] Russian Federation. *Air Code of the Russian Federation. Federal Law No. 60-FZ of 19 March 1997, as amended*.
- [16] Federal Air Transport Agency (Rosaviatsiya). *State Register of Civil Aerodromes and Airports of the Russian Federation, together with applicable regulatory documents governing airport certification and operation*. Moscow: Rosaviatsiya.
- [17] Horonjeff, R., McKelvey, F. X., Sproule, W. J., and Young, S. B. *Planning and Design of Airports*. 5th ed. McGraw-Hill, 2010.

- [18] Kazda, A., and Caves, R. E. *Airport Design and Operation*. 3rd ed. Emerald Group Publishing, 2015.
- [19] Graham, A. *Managing Airports: An International Perspective*. 6th ed. Routledge, 2023.
- [20] Doganis, R. *The Airport Business*. Routledge, 1992.
- [21] Rodríguez-Déniz, H., and Voltes-Dorta, A. “A Frontier-Based Hierarchical Clustering for Airport Efficiency Benchmarking.” *Benchmarking: An International Journal*, 21(4), 2014, pp. 486–508.
- [22] Rodríguez-Déniz, H., Suau-Sanchez, P., and Voltes-Dorta, A. “Classifying Airports According to Their Hub Dimensions: An Application to the US Domestic Network.” *Journal of Transport Geography*, 33, 2013, pp. 188–195.
- [23] Burghouwt, G. *Airline Network Development in Europe and its Implications for Airport Planning*. Ashgate, 2007.
- [24] Forsyth, P., Guiomard, C., and Niemeier, H.-M. *Airport Economics*. Routledge, 2023.
- [25] Stepanov, V. *Airport Functional Classification Standard (AFCS)*. WAIS Publishing, 2026.
- [26] Halpern, N., and Bråthen, S. “Impact of Airports on Regional Accessibility and Social Development.” *Journal of Transport Geography*, 19(6), 2011, pp. 1145–1154.
- [27] Stepanov, V. *WAIS World Airports Ranking 2025*. WAIS Publishing, 2026.



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