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Framework for integration and operation of smart community infrastructures

Part 2: Holistic approach and the strategy for development, operation and maintenance of smart community infrastructures

Annex of NWIP 37155-2

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86 Organization (WTO) principles in the Technical Barriers to Trade (TBT), see the following
87 URL: <http://www.iso.org/iso/foreword.html>

88 The committee responsible for this document is Technical Committee ISO/TC 268,
89 *Sustainable development in communities*, Subcommittee SC 1, *Smart community*
90 *infrastructures*.

91 Introduction

92 In the foreseeable future, urban density is likely to increase, resulting in further
93 urbanization complexity. From this perspective, a “smart community” approach is an
94 important concept to address such urban challenges by integrating different forms of
95 infrastructures in a rational and efficient manner.

96 An important aspect of a smart community is integrating infrastructures as “a system of
97 systems”. In addition to that, smart community has various stakeholders, including users,
98 and each smart community infrastructure has extended scope life-cycle (**Figure 1**).

99 Until now it has not been possible to ensure consistency across infrastructure types to
100 meet the requirements for smart community infrastructures as owners have focused on
101 just assembling solutions to each subsystem of infrastructures.

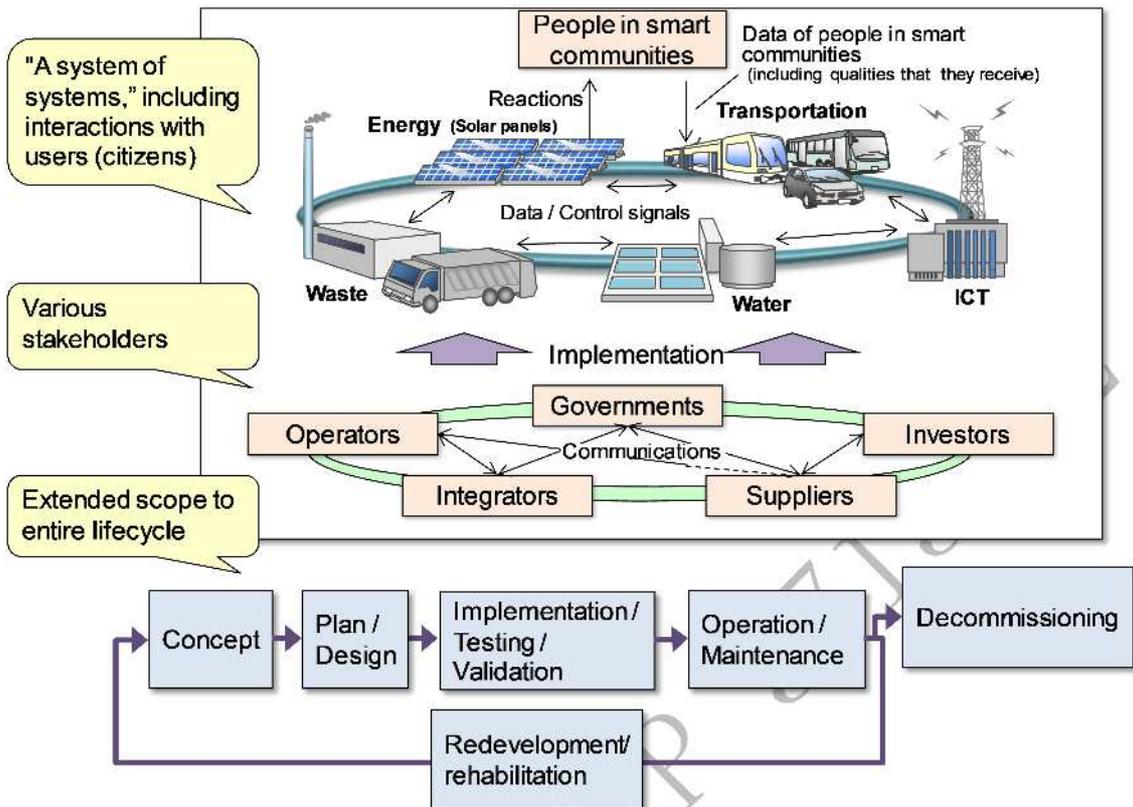
102 In order to ensure consistency of the specification of smart community infrastructures as a
103 whole, first, functions of each subsystem need to be clarified and arranged based on the
104 needs for a smart community, and secondly, the perspectives of various stakeholders and
105 lifecycle of infrastructures need to be considered.

106 To solve the above issues and realize well-functioning smart community infrastructures as
107 a whole, infrastructure development and operation processes are expected to include a
108 common framework, as described in TR 37152 “Common framework for development and
109 operation,” composed of three elements (**Figure 2**):

- 110 — element (A), allocation of consistent specification requirements to each component
111 of a system and validation of the allocating procedures;
- 112 — element (B), specification requirements associated with interaction and adoption of
113 adequate measures into planning and operation;
- 114 — element (C), process to facilitate information sharing and communication among
115 stakeholders.

116 This international standard (part 2) provides the guideline to realize element (A),
117 providing specification requirements to ensure consistency of smart community
118 infrastructure and to adopt adequate measures into planning and operation. Part 1 is
119 about element (B) and part 3 will be about element (C). Should it be required, guideline
120 document would be developed to support Part 1 to 3.

121



122

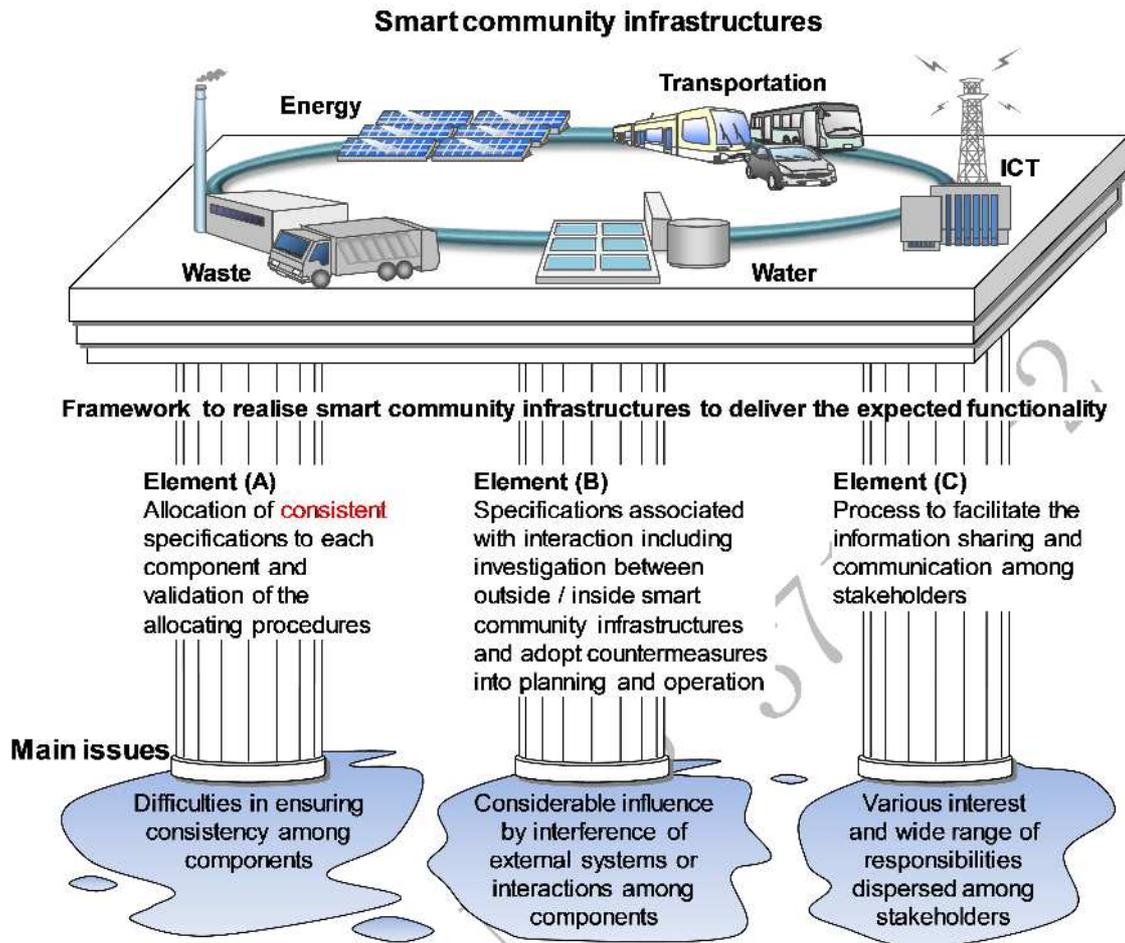
The infrastructures, stakeholders and lifecycle phases pictured in this figure are only some of the examples. Other infrastructure, such as urban agricultural system, might be included.

123

Figure 1 Characteristics of smart community infrastructure

124

Annex



125

126

Figure 2 Three elements of the framework

127 **Framework for integration and operation of smart community**
128 **infrastructures**

129

130 **Part 2: Holistic approach and the strategy for development, operation**
131 **and maintenance of smart community infrastructures**

132

133 **1 Scope**

134 This International Standard describes a framework (a set of processes and methodologies)
135 that will provide guidelines for the development, operation and maintenance of smart
136 community infrastructures to ensure the consistency of smart community infrastructures.

137 There are two potential use cases for this standard. The first is for the green field site,
138 where all the smart community infrastructures can be designed and developed at the same
139 time. This is of value to planners and investors of major new infrastructure developments.

140 The second builds on the first and will support efficient management of an existing urban
141 area by taking into account the increasing interdependencies of the infrastructures on
142 each other and the way they should be managed as system of systems. This standard will
143 also take into account accelerating technological and environmental changes.

144 Since this framework is concerned to ensure the consistency of different systems
145 consisting of smart community infrastructures, the scope of the proposed standard does
146 not overlap with any existing work or deliverables that are developed or being developed
147 at the existing TCs addressing issues at individual infrastructure level.

148 Note: This International Standard describes a management case (not a management
149 system), i.e. specific processes that an organization needs to follow in order to meet
150 specific objectives of this standard.

151

152 **2 Normative references**

153 The following documents, in whole or in part, are normatively referenced in this
154 document and are indispensable for its application. For dated reference, only the edition
155 cited applies. For undated references, the latest edition of the referenced document
156 (including any amendments) applies.

157 ISO TR 37152: 2016, Smart community infrastructures — Common framework for
158 development and operation

159 **3 Terms and definitions**

160 For the purposes of this document, the following terms and definitions apply.

161 **3.1**

162 **Risk**

163 effect of uncertainty on objectives

164 Note 1 to entry: An effect is a deviation from the expected — positive and/or negative.

165 Note 2 to entry: Objectives can have different aspects (such as financial, health and
166 safety, and environmental goals) and can apply at different levels (such as strategic,
167 organization-wide, project, product and process).

168 Note 3 to entry: Risk is often characterized by reference to potential events and
169 consequences, or a combination of these.

170 Note 4 to entry: Risk is often expressed in terms of a combination of the consequences
171 of an event (including changes in circumstances) and the associated likelihood of
172 occurrence.

173 Note 5 to entry: Uncertainty is the state, even partial, of deficiency of information
174 related to, understanding or knowledge of an event, its consequences or likelihood.

175 [SOURCE: ISO 31000:2009, Clause 2.1]

176 **3.2**

177 **Verification**

178 confirmation, through the provision of objective evidence, that specified requirements
179 have been fulfilled

180 Note 1 to entry: The objective evidence needed for a verification can be the result of an
181 inspection or of other forms of determination such as performing alternative calculations
182 or reviewing documents.

183 Note 2 to entry: The activities carried out for verification are sometimes called a
184 qualification process.

185 Note 3 to entry: The word “verified” is used to designate the corresponding status.

186 [SOURCE: ISO 9000:2015, Clause 3.8]

187 **3.3**

188 **Validation**

189 confirmation, through the provision of objective evidence, that the requirements for a
190 specific intended use or application have been fulfilled

191 Note 1 to entry: The objective evidence needed for a validation is the result of a test or
192 other form of determination such as performing alternative calculations or reviewing
193 documents.

194 Note 2 to entry: The word “validated” is used to designate the corresponding status.

195 Note 3 to entry: The use conditions for validation can be real or simulated.

196 [SOURCE: ISO 9000:2015, Clause 3.8]

197 **3.4**

198 **Developer**

199 organization that is responsible for the development and operation of smart community
200 by organizing smart community infrastructures as a whole, or a part of it.

201 Note: A developer may order operators to operate and maintain smart community
202 infrastructures.

203 Note: Tasks of 3.4, 3.5, 3.6, 3.10 are sometimes included in same organizations.

204 EXAMPLE Private developer, municipality, etc.

205 **3.5**

206 **Infrastructure owner**

207 organization that owns community infrastructure that is, or could be, smart

208 Note: An infrastructure owner may order operators to operate and maintain smart
209 community infrastructure.

210 Note: Tasks of 3.4, 3.5, 3.6, 3.10 are sometimes included in same organizations.

211 EXAMPLE Owner of railway tracks, owner of sewage lines, etc.

212 **3.6**

213 **Operator**

214 organization that is responsible to operate and maintain community infrastructure that
215 is, or could be, smart

216 Note: An operator may order service providers to supply a part of or the whole smart
217 community infrastructure(s).

218 Note: Tasks of 3.4, 3.5, 3.6, 3.10 are sometimes included in same organizations.

219 Note: Service provider is included in operator.

220 EXAMPLE Railway operator, power utilities, etc.

221 **3.7**

222 **Service provider**

223 organization that is responsible to supply a part of or the whole smart community
224 infrastructure(s)

225 EXAMPLE System integrator, component supplier, ICT vendor, etc.

226 **3.8**

227 **Consultant**

228 organization that consults, advise on or create solutions, and assists developers,
229 infrastructure owners, operators, service providers, community authority or investors
230 utilizing its expertise, through development, operation and maintenance of smart
231 community infrastructure

232 EXAMPLE Civil engineering firm, urban design engineering firm, etc.

233 **3.9**

234 **Community authority**

235 organization that develops and maintains regulations to ensure safety, quality, and other
236 important performances of smart community infrastructure

237 EXAMPLE Governmental agency, etc.

238 **3.10**

239 **Investor/lender**

240 organization that invests in/lends to developers, infrastructure owners and operators of
241 smart community infrastructure

242 Note: Tasks of 3.4, 3.5, 3.6, 3.10 are sometimes included in same organizations.

243 EXAMPLE Development bank, commercial bank, etc.

244 **3.11 Smart community infrastructure**

245 community infrastructure with enhanced technological performance that is designed,
246 operated, and maintained to contribute to sustainable development and resilience of the
247 community.

248 **3.12 People in smart community**

249 People in smart community are users or potential users of smart community
250 infrastructures, that should be considered as important stakeholder.

251 **4 Understanding of smart community infrastructure layers**

252 **4.1 Smart community infrastructure system layer**

253 This is the layer of whole integrated smart community infrastructures, a system of
254 systems, installed (or planned to be installed) in a specific smart community

255 **4.2 Smart community infrastructure layer**

256 This is the layer of an individual smart community infrastructure. Some of the examples
257 for the targets of this layer will be energy, water, transportation, waste management, and
258 ICT infrastructures.

259 Note: Smart community infrastructure can be structured using layered functional
260 blocks.

261 **4.3 Smart community sub-infrastructure layer**

262 This is the layer of the layered functional blocks of an individual smart community
263 infrastructure. Some of the examples in a transportation infrastructure for the targets of
264 this layer will be railway, LRT, public bus, rental bicycles, city roads, bridges and tunnels.

265 **5 Benefits of applying this standard**

266 **5.1 General**

267 This clause specifies main benefits that each stakeholder will have through applying this
268 standard.

269 **5.2 General benefits**

270 a) Estimate cost of operation and maintenance in the project planning & budgeting in
271 initial phase.

272 b) Identify issues and activities through the whole life cycle and take it into account as
273 much as possible in planning and budgeting activities.

274 c) Facilitate the allocation and understanding of responsibility related to the issues and
275 activities among stakeholders.

276 d) Achieve efficient allocation and optimization of energy and material resources, human
277 resources, and capital.

278 e) Reduce CO₂ emission and environmental loads, as result of efficient allocation and
279 optimization of energy and material resources.

280 f) Facilitate coordination and cooperation between stakeholders.

281 **5.3 Benefits for community authorities**

282 a) Facilitate identifying opportunities for synergies and identifying risks associated with
283 interactions between multiple smart community infrastructures.

284 b) For ensuring safety and security of the community, facilitate developing regulations,
285 which are related to infrastructure and community activities, by utilizing risk
286 information.

287 **5.4 Benefits for investors or lenders**

288 a) Decide to invest/loan based on identification of risks at earlier point.

289 b) Monitor project status to watch for investment/loan control.

290 **5.5 Benefits for developers, infrastructure owners, and operators**

291 a) Achieve high efficiency and quality of the entire smart community infrastructures.

292 b) Facilitate effective procurement management and efficient project management by
293 preventing reworks due to inconsistency or mismatches among components.

294 c) Facilitate accountability for conformity with objectives and needs for infrastructure
295 development.

296 d) Achieve efficient operation and maintenance of smart community infrastructures.

297 e) Facilitate effective risk management by utilizing insurances.

298 5.6 Benefits for service providers

299 Benefits for service providers are

300 a) Clarify system requirements for the service providers.

301 b) Provide means for efficient project management as well as accomplishing
302 accountability for how much the system contributes to meeting the objectives and
303 needs for smart community infrastructures development.

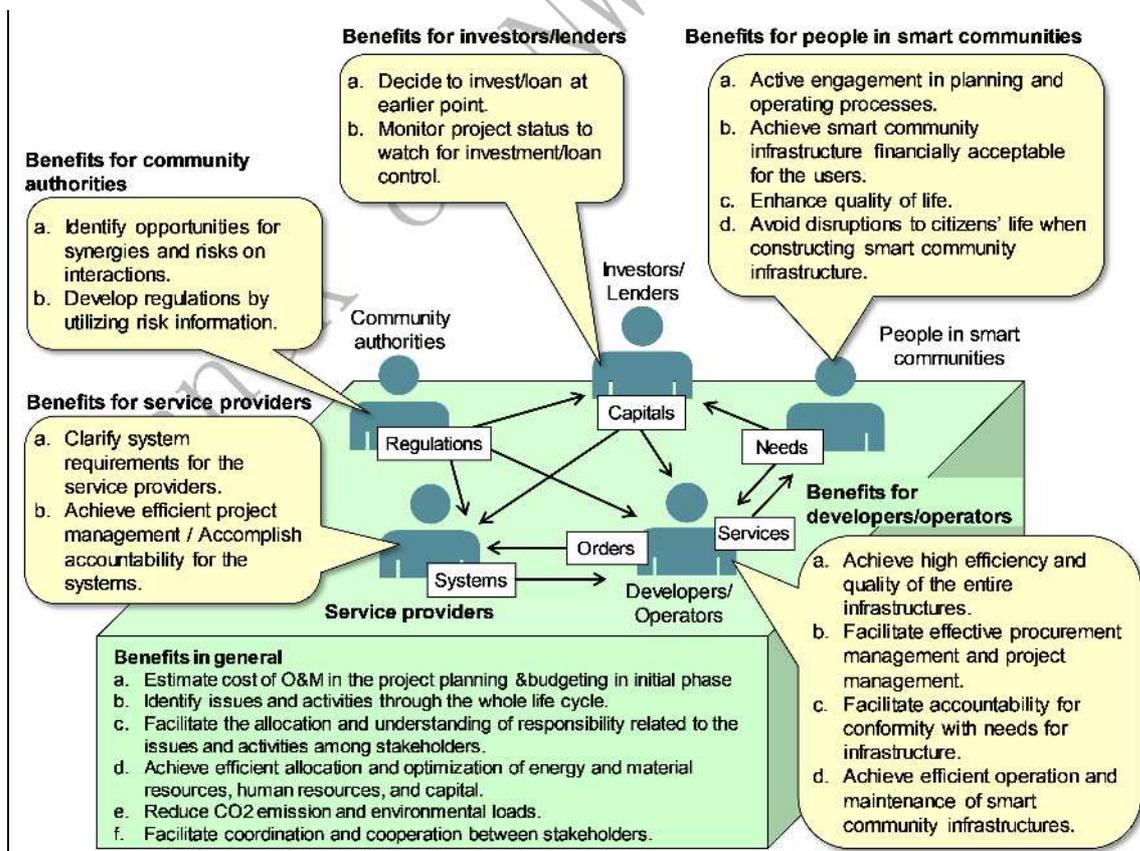
304 5.7 Benefits for people in smart communities

305 a) Facilitate active engagement as a important stakeholder in planning and operating
306 processes through e.g. data sharing and user data acquisition.

307 b) Achieve cost effective smart community infrastructure financially acceptable for the
308 users.

309 c) Enhance quality of life due to more effective and reliable infrastructure performance
310 as a whole.

311 d) Avoid disruptions to citizens' life when constructing smart community infrastructure,
312 which can be achieved by optimized construction plan in which interactions between
313 the construction and citizens are considered.



314

315

Figure 3 Benefits of applying this standard

316

317 **6 Life cycle phases of smart community infrastructure**

318 **6.1 General**

319 This clause specifies life cycle phases of smart community infrastructure and provides
320 examples of the activities that may be conducted in each phase. The purpose of this
321 clause is to share the image of the activities, not to define or rule the activities that
322 should be conducted, in each phase.

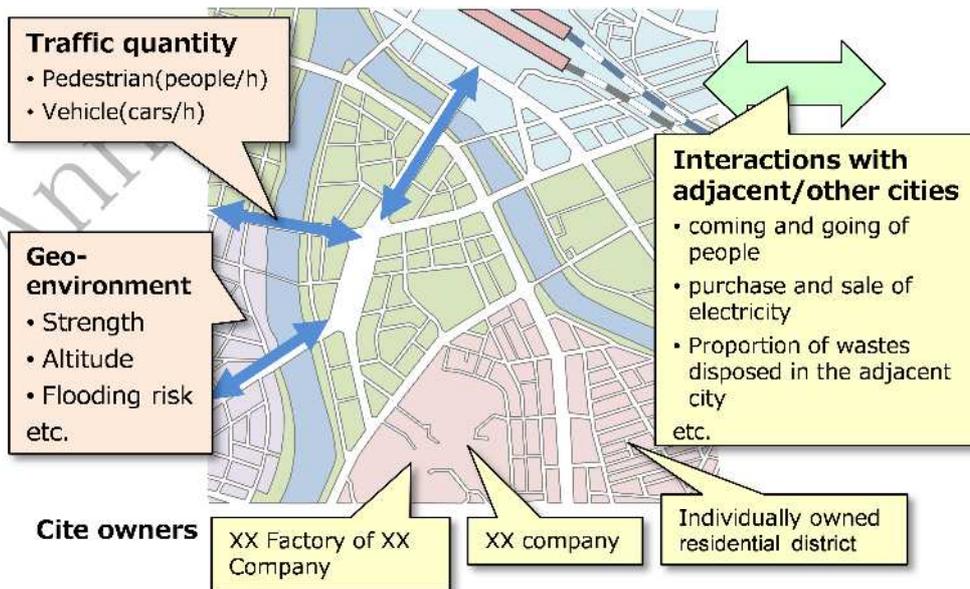
323 **6.2 Initiation (Phase 1)**

324 **6.2.1 Smart community concept (Phase 1-1)**

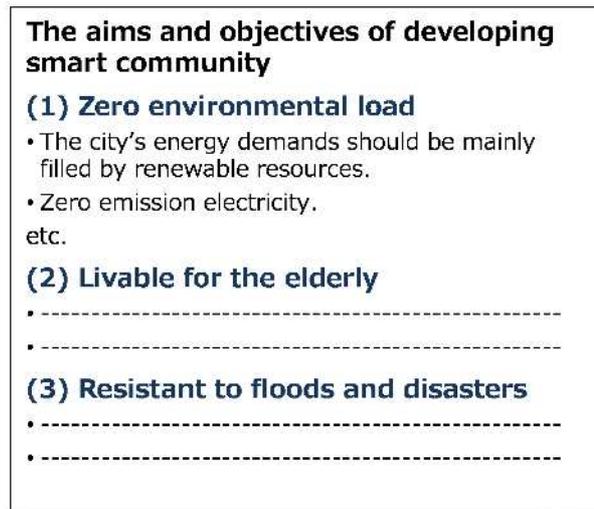
325 This is the phase mainly for developing smart community concept.

326 In this phase,

- 327 **a)** developers clarify the development background,
- 328 **b)** consultants clarify the current state of and the needs for the target community (or
329 area) through investigations, and
- 330 **c)** developers decide the scope of the project (ex. needs to be satisfied) and develop the
331 basic concept of the smart community as a whole.
- 332 **d)** developers advise different stakeholders on potential concepts or conceptual solution
333 and their impact.



334



336

337

Figure 5 Image of a smart community concept

338 6.3 Design of target infrastructures (Phase 2)

339 6.3.1 Basic concept (Phase 2-1)

340 This is the phase mainly for developing, in accordance with smart community concept,
341 basic concept of smart community infrastructure.

342 In this phase,

343 **a)** developers or consultants clarify the goals of the infrastructures as a whole and the
344 approaches to achieve them,

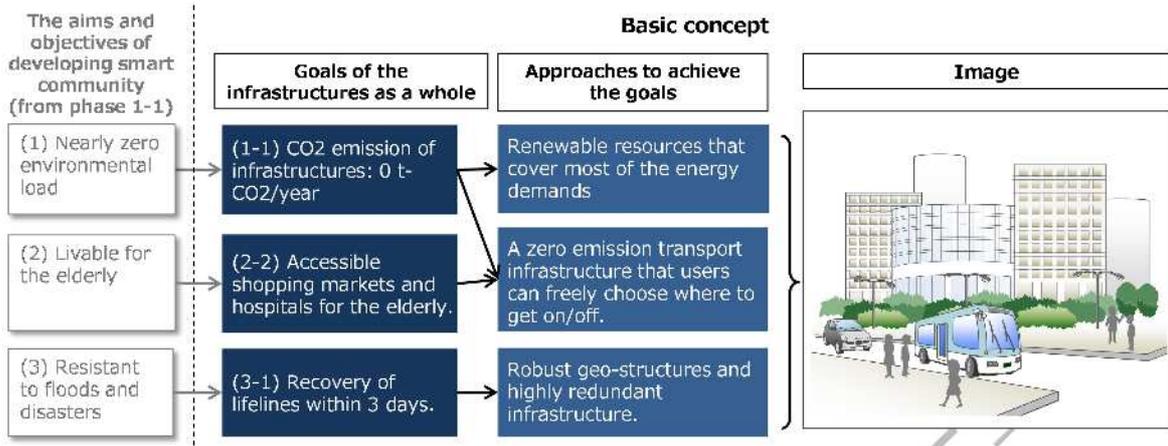
345 **b)** consultants develop a list of possible critical risks from the basic concept, and

346 **c)** developers or consultants are expected to find synergies between different
347 infrastructures needs and goals and suggest concepts, platforms solutions that are
348 common or reusable for more than one infrastructure.

349 Note1 to entry: The infrastructure systems are not necessarily decided at this phase.

350 Note2 to entry: At some stage in the process, the consultants will need to be selected.

351 The selection criteria should focus on the consultant's qualifications to undertake the
352 project and not the price for their services. Consultants with a proven history on such
353 projects are critical. Quality Based Selection (QBS) methods should be used.



354

355

Figure 6 Image of a basic concept

356 6.3.2 Basic plan (Phase 2-2)

357 This is the phase mainly for developing, in accordance with its basic concept, basic plan
 358 of smart community infrastructure.

359 In this phase,

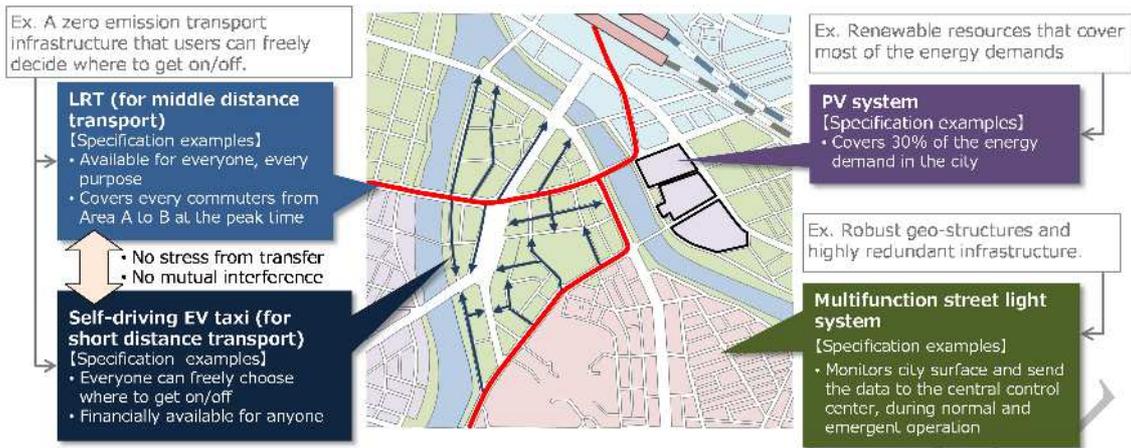
360 a) developers and consultants are expected to find solutions that are offering horizontal
 361 approach ie are common or reusable for different infrastructures or ie enable data
 362 exchange or umbrella monitoring & control of different infrastructures

363 b) developers or consultants clarify infrastructure combinations to achieve the basic
 364 concept,

365 c) developers or consultants clarify fundamental specifications of functions for each
 366 infrastructure system,

367 d) developers select the infrastructure owner or operator of each infrastructure system
 368 (ex. a private company operates by the PPP scheme), and

369 e) consultants identify interfaces with external/existent infrastructures and conducts
 370 risk assessment related to the interfaces.



371

372

Figure 7 Image of a basic plan

373 **6.3.3 Fundamental design (Phase 2-3)**

374 This is the phase mainly for developing, in accordance with its basic plan, fundamental
 375 design of smart community infrastructure.

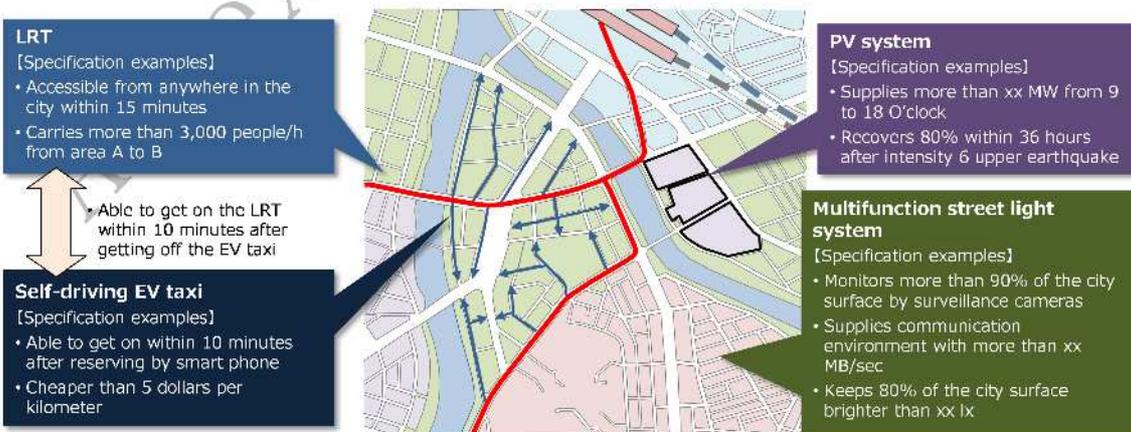
376 In this phase, consultants

377 a) clarify external (quantified) specifications of each infrastructure system (the system
 378 composition is not necessarily clarified),

379 b) clarify important specifications such as the fee standard and CO2 emission level of
 380 each infrastructure system, or whether it is self-driven or not, etc,

381 c) presents necessary Operation and Maintenance activities after built or installation
 382 phase so that the planning could include the whole project lifecycle cost - or Total
 383 Cost of Ownership, and

384 d) conduct risk assessment according to the fundamental design.



385

386

Figure 8 Image of a fundamental design

387 **6.3.4 Tendering (Phase 2-4)**

388 This phase is mainly about deciding the winning bidder.

389 In this phase, developers conduct bidding, select the winning bidder, and pass the order.

390 Note1 to entry: In this phase, developers with support from Consultants can select
391 most appropriate bidding procedure.

392 Note2 to entry: This phase can be about framing the contract for the delivery of the
393 project. Consideration needs to be given to the most appropriate procurement model
394 for the specific project; selection processes for choosing bidders which focus on their
395 qualifications, experience, and ability to successfully achieve the projects goals – rather
396 than just price.

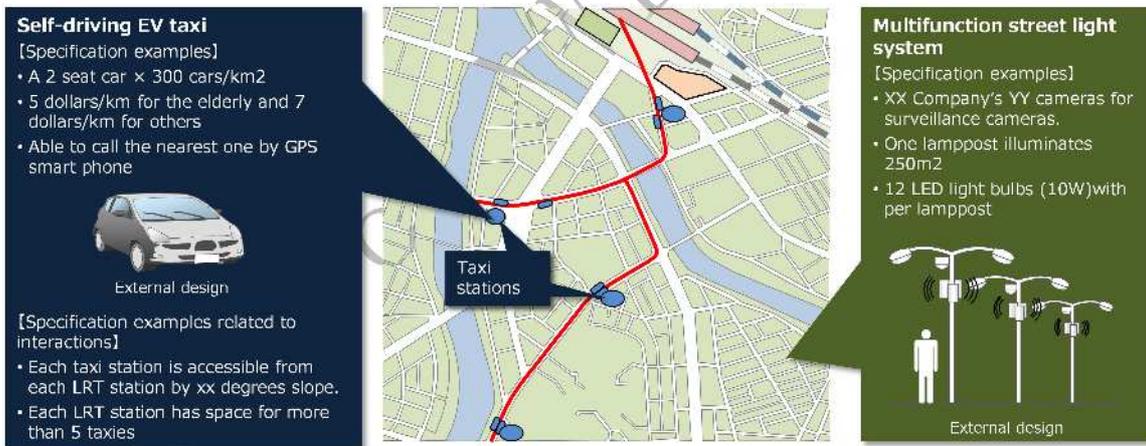
397 **6.3.5 Implementation design (Phase 2-5)**

398 This is the phase mainly for developing, in accordance with its fundamental design,
399 implementation design of smart community infrastructure.

400 In this phase,

401 a) winning bidders (operators or service providers) clarify implementation designs, and

402 b) consultants conduct risk assessment according to the implementation design.



403

404

Figure 9 Image of implementation design

405 **6.4 Construction and assessment (Phase 3)**

406 **6.4.1 Manufacturing, construction, and installation (Phase 3-1)**

407 This is the phase for manufacturing, construction, and installation of smart community
408 infrastructure in accordance with its implementation design.

409 In this phase, service provides manufacture smart community infrastructure
410 components and construct and install smart community infrastructure in accordance
411 with the designs.

412 **6.4.2 Individual and combination tests and validation (Phase 3-2)**

413 This is the phase for individual and combination tests and validation of smart community
414 infrastructure. The target of individual tests is a specific component, a subsystem or a
415 system of a smart community infrastructure. Through individual tests, it is determined
416 whether the component, subsystem or system meets specified requirements. The target
417 of combination tests is the combination of multiple components, subsystems, systems or
418 smart community infrastructures. Through combination tests, it is determined whether
419 these combinations meet specified requirements.

420 In this phase,

- 421 a) service provides and/or third parties conduct individual tests of infrastructure
422 components and systems and combination tests of infrastructure systems, and
423 b) developers, infrastructure owners, and operators accept or reject, based on the test
424 results, the components, subsystem, systems, or smart community infrastructures.

Individual tests of infrastructure components and systems

- [Test items for EV taxi (ex.)]
- How properly the self-driving system functions.
 - How properly the smartphone reservation system functions.
- * The tests will be conducted in the suppliers' sites or their test courses.



Combination tests of infrastructure systems

- [Test items for EV taxi (ex.)]
- Whether a user can get on a taxi within 10 minutes after he reserved.
 - Whether the taxis can cope with the passengers in a taxi station within 10 minutes.
- * The tests will be conducted in real site or by simulation.



425

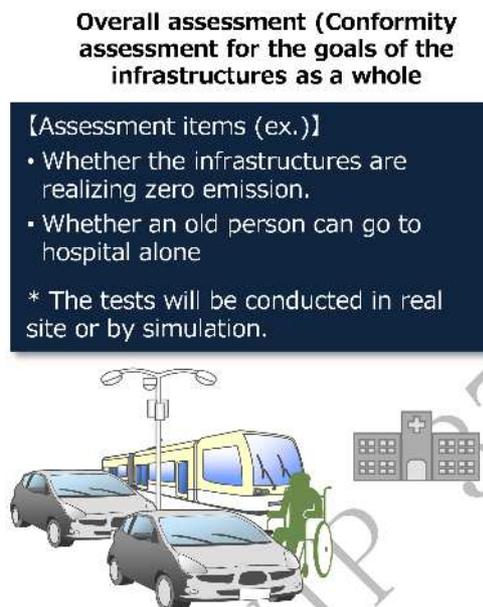
426 **Figure 10 Image of individual and combination tests and validation**

427 **6.4.3 Overall assessment of smart community infrastructures as a whole** 428 **(Phase 3-3)**

429 This is the phase for overall assessment of smart community infrastructures as a whole.
430 The purpose of the assessment is to determine whether the design and construction of

431 the smart community infrastructures as a whole has met the goals set as part of the basic
432 concept of smart community infrastructure at phase 2-1.

433 The assessment will be conducted at the direction of the developer, infrastructure owner,
434 or operator.



435
436 **Figure 11 Image of overall assessment of smart community infrastructure as a**
437 **whole**

438 **6.5 Operation and maintenance (Phase 4)**

439 This is the phase mainly for operation and maintenance of smart community
440 infrastructure.

441 In this phase, the operator of each infrastructure system

442 **a)** conducts operation and maintenance according to the plans which includes when
443 possible information gathered from smart community infrastructure in order to
444 introduce preventive and /or predictive maintenance and lower the cost and increase
445 safety, and

446 **b)** addresses the risks that newly arise (or that are newly identified) in the operation.

447 **6.6 Redevelopment and rehabilitation (Phase 5)**

448 In this phase, developers

449 **a)** develop plans which includes when possible information/data gathered from smart
450 infrastructure in order to introduce controlled lifetime extension and reduce cost and
451 increase safety for redevelopment or rehabilitation of smart community
452 infrastructure, and

453 **b)** conduct redevelopment or rehabilitation of smart community infrastructure in
454 accordance with the plans.

455 Note: Adaptation, modification and conversion of smart city infrastructures are included
456 in redevelopment.

457 **6.7 Decommissioning (Phase 6)**

458 In this phase, developers

459 **a)** Use and analyse data collected from smart infrastructure in order to perform
460 decommissioning in the most cost efficient and safe way,

461 **b)** develop plans for decommissioning of smart community infrastructure, and

462 **c)** conduct decommissioning of smart community infrastructure in accordance with the
463 plans.

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464 **7 General process to ensure consistency**

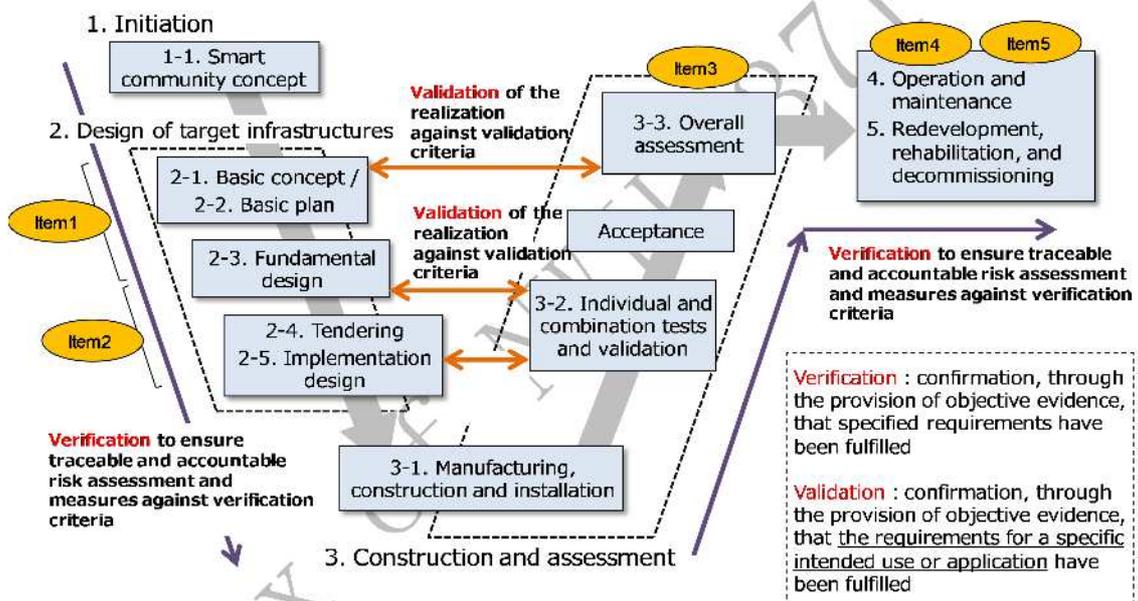
465 **7.1 General**

466 This clause specifies the general process to ensure consistency in order to achieve
467 effective and efficient development, operation and maintenance of smart community
468 infrastructures.

469 **7.2 Process overview**

470 The process to ensure consistency should be based on a “V process” as presented in
471 **Figure 12.**

472 Note: In real life implementation, there might be some overlapping of V processes.



473

474 **Figure 12 “V process” for the standard**

475

476 **7.3 Action items in V process (2. of Figure 12)**

477 **7.3.1 Item1 : Setting the targets for infrastructures**

478 In order to achieve the goal of the smart community, relevant infrastructures should be
479 identified and the targets for those infrastructures should be set.

480 Example : Targets could be

481 — to point out the special area to be served.

482 — to improve energy efficiency.

483 **7.3.2 Item2 : Analyse the solutions for different infrastructures to achieve the**
484 **targets**

485 In order to achieve the targets, the possible solutions should be analysed which based on
486 risk assessment.

487 **7.3.3 Item3 : Validation and Verification**

488 The solutions should be validated and verified after all relevant phases and before
489 solutions put into operation in order to meet the targets.

490 **7.3.4 Item4 : Monitoring the performance of infrastructures**

491 The assigned performance of infrastructures should be monitored and data should be
492 collected in order to meet the goals.

493 **7.3.5 Item5 : Improve the targets**

494 In order to achieve the goals, the targets of infrastructures should be improved if
495 necessary.

496 **8 Guidelines for ensuring consistency**

497 **8.1 General**

498 This clause details Recommendations to be undertaken throughout each life cycle phase
499 to realize validation and verification in ensuring consistency of smart community
500 infrastructure. The scope and application of the Recommendations shall/should be
501 assessed and adapted to meet the particular Recommendations of the target
502 infrastructure.

503 **8.2 Smart community concept (Phase 1-1)**

504 **8.2.1 Recommendations for verification and validation**

505 **8.2.1.1** When clarifying the backgrounds of the development

506 a) the development background of smart community and target infrastructure
507 shall/should be clarified.

508 **8.2.1.2** When clarifying the current state and needs,

509 a) the environment of smart community, including physical, potential system interface,
510 social, political, legislative, economical issues, shall/should be clarified.

511 **b)** The needs for development of smart community and target infrastructure
512 shall/should be clarified.

513 **8.2.1.3** When developing the basic concepts of smart community as a whole,

514 **a)** The goals of smart community and target infrastructure shall/should be clarified.

515 **8.2.2 Responsibility**

516 Developers that are responsible for the development of the target infrastructure may be
517 responsible for the undertaking of the recommendations shown in 8.2.1.

518 **8.3 Basic concept (Phase 2-1)**

519 **8.3.1 Recommendations for verification**

520 **8.3.1.1** When developing the basic concept of smart community infrastructures,

521 **a)** the infrastructures to achieve the goal of the smart community shall/should be
522 clarified, and

523 **b)** based on the goal of smart community, the goal of each infrastructures shall/should
524 be allocated.

525 **8.3.1.2** When addressing the risks that can be identified from the basic concept,

526 **a)** the environment of target infrastructure, including physical, potential system
527 interface, social, political, legislative, economical issues, shall/should be clarified, and

528 **b)** risks shall/should be sufficiently identified from the feasibility studies.

529 **8.3.2 Recommendations for validation**

530 **8.3.2.1** When developing the basic concept of smart community infrastructures,
531 addressing the risks that can be identified from the basic concept,

532 **a)** achievement criteria for the goals of infrastructures as a whole and their evaluation
533 methods shall/should be clarified, and

534 **b)** management policies and processes in case of shortfall of the goals shall/should be
535 clarified.

536 **8.3.3 Responsibility**

537 Developers that are responsible for the development of the target infrastructure may be
538 responsible for the undertaking of the recommendations shown in 8.3.1 and 8.3.2.

539 **8.4 Basic plan (Phase 2-2)**

540 **8.4.1 Recommendations for verification**

541 **8.4.1.1** When developing the basic plan,

542 a) functions and performances necessary to achieve the goal of target infrastructure
543 shall/should be allocated to sub-infrastructures.

544 **8.4.1.2** When addressing the risks that can be identified from the basic plan,

545 a) risks that will be caused by the allocated functions and performances shall/should be
546 identified and evaluated, and

547 b) the basic plan of the target infrastructure shall/should be based on the result of the
548 risk assessment.

549 **8.4.2 Recommendations for validation**

550 **8.4.2.1** When developing the basic plan, addressing the risks that can be identified
551 from the basic plan,

552 a) achievement criteria of functional specifications for each infrastructure system and
553 the methodologies to evaluate the achievement shall/should be clarified, and

554 b) management policies and processes in case of incomplete specification shall/should
555 be clarified.

556 **8.4.3 Responsibility**

557 Developers that are responsible for the development of the target infrastructure may be
558 responsible for the undertaking of the Recommendations shown in 8.4.1 and 8.4.2.

559 **8.5 Fundamental design (Phase 2-3)**

560 **8.5.1 Recommendations for verification**

561 **8.5.1.1** When developing the fundamental design,

562 a) external specifications for sub-infrastructures shall/should be set in accordance with
563 the risk assessment conducted in the basic plan.

564 **8.5.1.2** When addressing the risks that can be identified from the fundamental
565 design,

566 a) risks that will be caused by the external specifications shall/should be identified and
567 evaluated, and

568 b) the fundamental design of the target infrastructure and sub-infrastructure
569 shall/should be based on the result of the risk assessment.

570 **8.5.2 Recommendations for validation**

571 **8.5.2.1** When developing the fundamental design and addressing the risks that can
572 be identified from the fundamental design,

573 a) achievement criteria of external specifications for each infrastructure system and the
574 methodologies to evaluate the achievement shall/should be clarified, and

575 b) management policies and processes in case of incomplete specifications shall/should
576 be clarified.

577 **8.5.3 Responsibility**

578 Developers that are responsible for the development of the target infrastructure may be
579 responsible for the undertaking of the recommendations shown in 8.5.1 and 8.5.2.

580 **8.6 Tendering (Phase 2-4)**

581 **8.6.1 Recommendations for verification**

582 **8.6.1.1** When conducting tender,

583 a) tender requirements shall/should be set in accordance with the fundamental design,
584 and

585 b) requirements to select operators/service providers properly according to the risk
586 level of the target infrastructure shall/should be included in tender requirements.

587 **8.6.1.2** In evaluation and selection of tender documents,

588 a) tender documents (which are awarded contract) shall/should meet tender
589 requirement of target infrastructure/sub-infrastructure, and

590 b) Total Cost of Ownership (TCO) for the target infrastructure shall/should be
591 considered.

592 **8.6.1.3** When awarding contract,

593 a) Tender documents (which are awarded contract) shall/should meet tender
594 requirement of target infrastructure/sub-infrastructure.

595 b) Total Cost of Ownership (TCO) for the target infrastructure shall/should be
596 considered.

597 **8.6.2 Responsibility**

598 Developers that are responsible for the development of the target infrastructure may be
599 responsible for the undertaking of the Recommendations shown in 8.6.1 and エラー! 参
600 照元が見つかりません。 .

601 **8.7 Implementation design (Phase 2-5)**

602 **8.7.1 Recommendations for verification**

603 **8.7.1.1** When developing the implementation design,

604 a) implementation design specifications shall/should be set in accordance with the
605 tender documents.

606 **8.7.1.2** When addressing the risks that can be identified from the implementation
607 design,

608 a) risks that will be caused by the allocated functions and performances in
609 implementation design shall/should be identified and evaluated, and

610 b) the implementation design of the target infrastructure and sub-infrastructure
611 shall/should be based on the result of the risk assessment

612 **8.7.1.3** When developing the operation and maintenance manuals,

613 a) every risk that cannot be sufficiently mitigated by the external specifications of the
614 infrastructure systems should be addressed by the manuals, and

615 b) the process, built in operation and maintenance, to continuously extract interactions
616 and related risks and to conduct risk assessment shall/should be established.

617 **8.7.2 Recommendations for validation**

618 **8.7.2.1** When developing the implementation design and addressing the risks that
619 can be identified from the implementation design,

620 a) achievement criteria of implementation design specifications and the methodologies
621 to evaluate the achievement shall/should be clarified, and

622 b) management policies and processes in case of incomplete specifications shall/should
623 be clarified.

624 **8.7.2.2** When developing the operation and maintenance manuals,

625 a) the processes to validate the manuals (and to revise them if necessary) in the
626 operation and maintenance phase shall/should be clarified.

627 **8.7.3 Responsibility**

628 Operators and service providers that are responsible for the development of the target
629 infrastructure may be responsible for the undertaking of the recommendations shown in
630 8.7.1 and 8.7.2.

- 631 **8.8 Manufacturing, construction, installation (Phase 3-1)**
- 632 **8.8.1 Recommendations for verification**
- 633 **8.8.1.1** In manufacturing, construction, installation,
- 634 a) the whole processes, related to manufacturing, construction and installation
635 conducted in this phase shall/should be documented.
- 636 **8.8.2 Recommendations for validation**
- 637 **8.8.2.1** In manufacturing, construction, installation,
- 638 a) it shall/should be established that the processes are conducted in conformity to
639 manufacturing, construction and installation plan.
- 640 **8.8.3 Responsibility**
- 641 Operators and service providers that are responsible for the development of the target
642 infrastructure may be responsible for the undertaking of the recommendations shown in
643 8.8.1 and 8.8.2.
- 644 **8.9 Individual and combination tests and validation (Phase 3-2)**
- 645 **8.9.1 Recommendations for verification**
- 646 **8.9.1.1** When conducting individual tests of infrastructure systems,
- 647 a) every test item related to individual performance of each infrastructure system
648 shall/should be conducted, and
- 649 b) every process conducted in the tests shall/should be documented.
- 650 **8.9.1.2** When conducting combination tests of infrastructure systems,
- 651 a) every test item related to influence of integrating infrastructure systems shall/should
652 be conducted, and
- 653 b) every process conducted in the tests shall/should be documented.
- 654 **8.9.2 Recommendations for validation**
- 655 **8.9.2.1** When conducting individual tests of infrastructure systems,
- 656 a) the validation plan of the implementation design specifications shall/should be
657 clarified, and
- 658 b) validation shall/should be conducted in conformity to the plan.
- 659 **8.9.2.2** When conducting combination tests of infrastructure systems,
- 660 a) the validation plans of the external specifications and specifications of functions
661 shall/should be clarified, and
- 662 b) validation shall/should be conducted in conformity to the plans.

663 **8.9.3 Responsibility**

664 Operators and service providers that are responsible for the development of the target
665 infrastructure may be responsible for the undertaking of the recommendations shown in
666 8.9.1 and 8.9.2.

667 **8.10 Overall assessment and validation (Phase 3-3)**

668 **8.10.1 Recommendations for verification**

669 **8.10.1.1** When conducting overall assessment (conformity assessment) for the goals
670 of the infrastructures as a whole,

- 671 a) every item for overall performance assessment which are considered in actual
672 environment shall/should be conducted, and
673 b) every process conducted in the assessment shall/should be documented.

674 **8.10.2 Recommendations for validation**

675 **8.10.2.1** When conducting overall assessment (conformity assessment) for the goals
676 of the infrastructures as a whole,

- 677 a) validation plan on entire infrastructure shall/should be clarified, and
678 b) validation shall/should be implemented in conformity to the validation plan.
679 c) the result of overall assessment shall/should be feedbacked to design/operation/
680 maintenance of the smart community infrastructure.

681 **8.10.3 Responsibility**

682 Developers that are responsible for the development of the target infrastructure may be
683 responsible for the undertaking of the recommendations shown in 8.10.1 and 8.10.2.

684 **8.11 Operation and maintenance (Phase 4)**

685 **8.11.1 Recommendations for verification**

686 **8.11.1.1** In normal operation and maintenance,

- 687 a) operation and maintenance plans shall/should be developed in conformity to
688 operation and maintenance manuals,
689 b) to address properly the new risks arose or identified in this phase, risk information,
690 and therefore operation and maintenance procedures, shall/should be regularly
691 renewed, and
692 c) status of the achievement of overall objectives of target infrastructure shall/should be
693 regularly monitored, and the redevelopment plan shall/should be revised in
694 accordance with the results, and
695 d) it shall/should be clarified that operation and maintenance are conducted in
696 conformity to operation and maintenance plans.

- 697 **8.11.1.2** In emergency operation,
- 698 a) it shall/should be clarified that emergency operation was performed in accordance
699 with the emergency operation manual.
- 700 **8.11.1.3** When addressing the risks that can be identified in operation and
701 maintenance,
- 702 a) all infrastructure systems and components newly raised or identified through
703 operation and maintenance shall/should be identified,
- 704 b) based on the infrastructure systems and components, all scenarios that can cause
705 risks shall/should be clarified,
- 706 c) from the scenario, all the risks shall/should be identified and assessed, and
- 707 d) mitigations for each risk shall/should be allocated to the operation/maintenance
708 manuals or to the refurbishment plan.
- 709 **8.11.2 Recommendations for validation**
- 710 **8.11.2.1** In normal operation and maintenance,
- 711 a) validation plan on entire infrastructure shall/should be clarified,
- 712 b) validation shall/should be implemented in conformity to the validation plan, and
- 713 c) the contingency plan for the case the objectives of entire infrastructure are not
714 achieved shall/should be clarified.
- 715 **8.11.3 Responsibility**
- 716 Operators and/or entities that are responsible for the operation/maintenance of the
717 target infrastructure may be responsible for the undertaking of the recommendations
718 shown in 8.11.1 and 8.11.2.
- 719 **8.12 Redevelopment and rehabilitation (Phase 5)**
- 720 **8.12.1 Recommendations for verification and validation**
- 721 **8.12.1.1** When developing a plan for redevelopment/rehabilitation, and implementing
722 the redevelopment/rehabilitation plan,
- 723 a) redevelopment/rehabilitation shall/should be conducted basically in accordance with
724 phase 1 to 4 of the life cycle phases presented in Chapter 6 of 37155, and
- 725 b) redevelopment/rehabilitation shall/should be conducted in conformity with the
726 requirements presented in related life cycle phases in Chapter 9 of 37155.
- 727 **8.12.2 Responsibility**
- 728 The entity responsible for undertaking the recommendations depends on the life cycle
729 phase. Possible responsibility in each life cycle phase is shown from 9.2 to 9.11 of 37155.

730 **8.13 Decommissioning (Phase 6)**

731 **8.13.1 Recommendations for verification**

732 **8.13.1.1** When developing plans for decommissioning,

733 **a)** decommissioning plan shall/should be developed to:

734 - manage the allocation and their risks related to decommissioning of the target
735 infrastructure

736 - ensure the continued achievement of objectives of the entire infrastructure, and

737 **b)** the allocation of target infrastructure from the decommissioning plan shall/should be
738 identified.

739 **c)** based on the allocation of target infrastructure, sufficient scenarios associated with
740 risks shall/should be identified, and

741 **d)** from the scenario, all the risks shall/should be identified and assessed, and

742 **e)** decommissioning plan shall/should be based on the result of the risk assessment

743 **8.13.1.2** When conducting decommissioning,

744 **a)** decommissioning shall/should be conducted in conformity to the decommissioning
745 plan.

746 **8.13.2 Recommendations for validation**

747 **8.13.2.1** When developing plans for decommissioning and conducting the plan,

748 **a)** validation plan for decommissioning shall/should be clarified,

749 **b)** validation shall/should be implemented in conformity to the validation plan, and

750 **c)** the contingency plan for the case the objectives of entire infrastructure are not
751 achieved shall/should be clarified.

752 **8.13.3 Responsibility**

753 Developers, operators and/or entities that are responsible for the decommissioning of
754 the target infrastructure may be responsible for the undertaking of the
755 recommendations shown in 8.13.18.11.1 and 8.13.2.

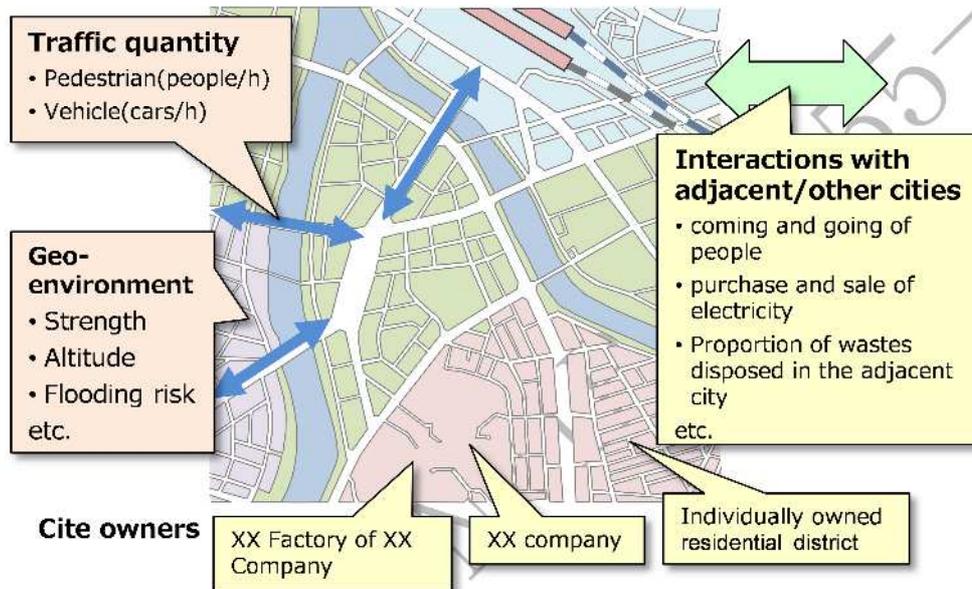
756

757 **Annex A. Case studies of applying this standard for green field site**

758 **A.1 Initiation (Phase 1)**

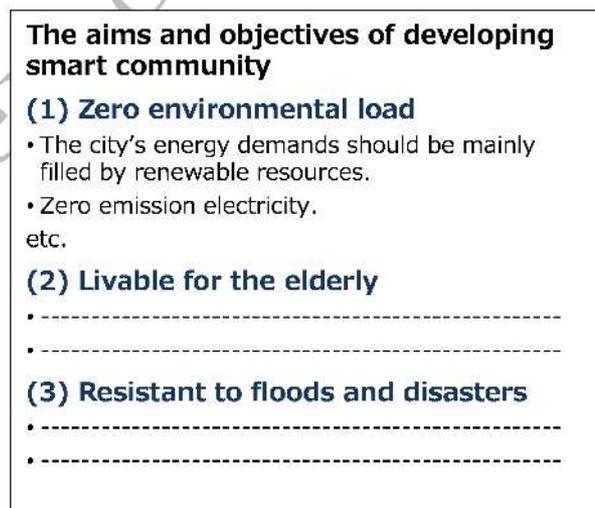
759 **A.1.1 Smart community concept (Phase 1-1)**

760 This is the phase mainly for developing smart community concept, including clarification
761 of the current state of and the needs for the target community (or area) through
762 investigations. Example images of clarifying the current state of the target area and of a
763 smart community concept are presented in the following diagram.



764

765 **Figure 13 An example image of clarifying the current state of the target area**



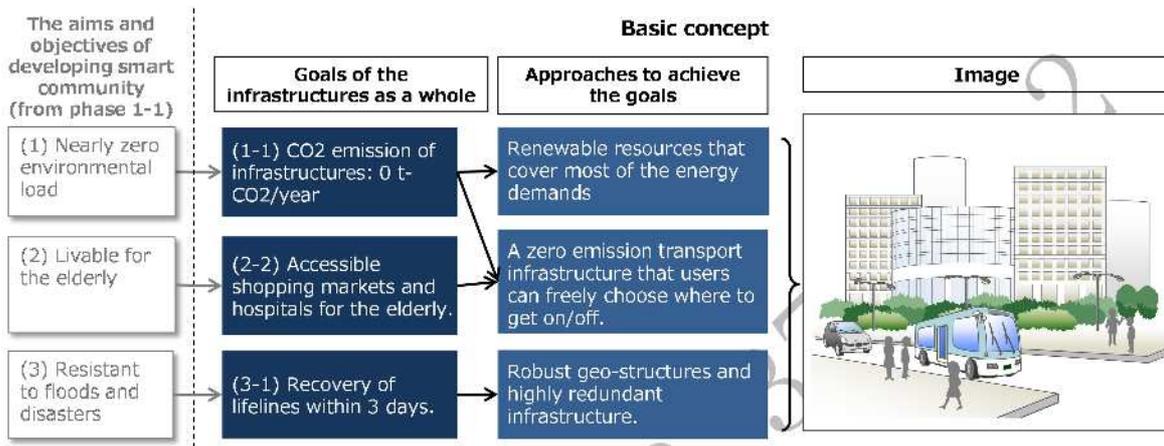
766

767 **Figure 14 An example image of a smart community concept**

768 **A.2 Design of target infrastructures (Phase 2)**

769 **A.2.1 Basic concept (Phase 2-1)**

770 This is the phase mainly for developing, in accordance with smart community concept,
 771 basic concept of smart community infrastructure. An example image of a basic concept is
 772 presented in the following diagram.

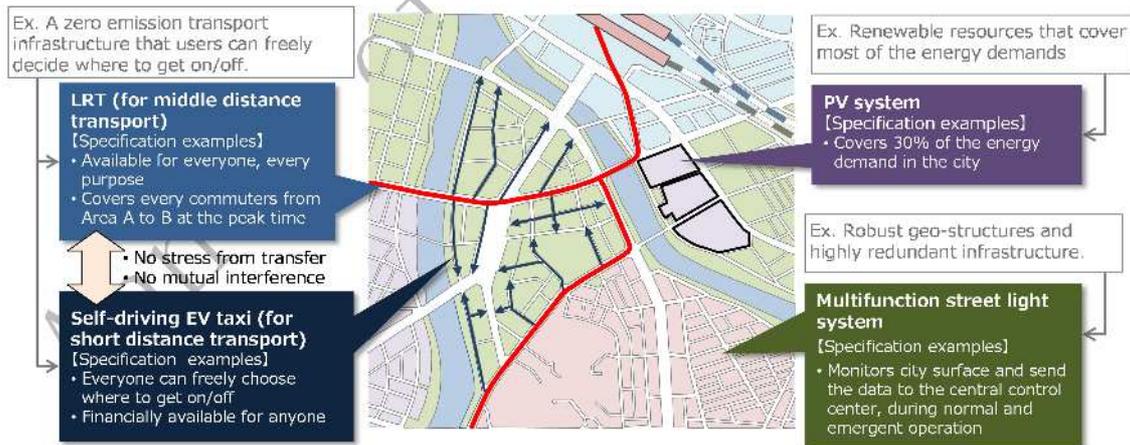


773
774

Figure 15 An example image of a basic concept

775 **A.2.2 Basic plan (Phase 2-2)**

776 This is the phase mainly for developing, in accordance with its basic concept, basic plan
 777 of smart community infrastructure.

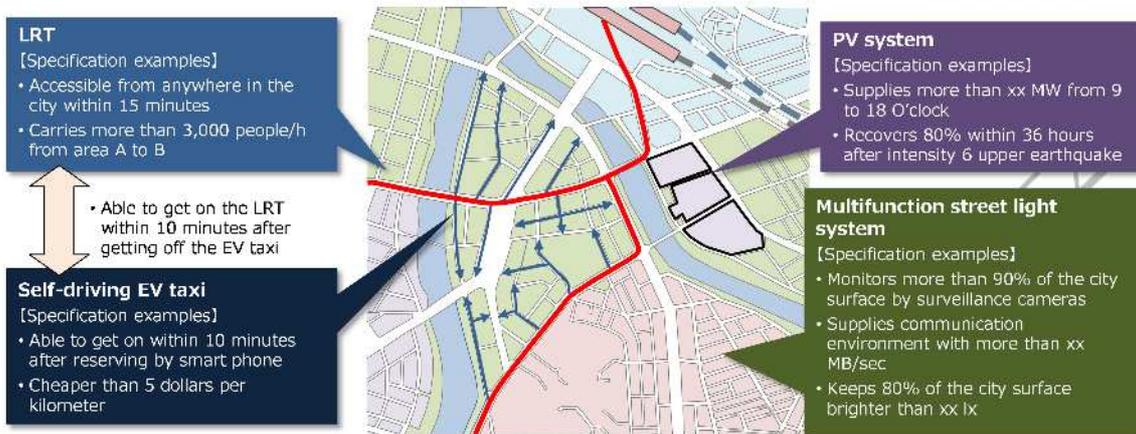


778
779

Figure 16 An example image of a basic plan

780 **A.2.3 Fundamental design (Phase 2-3)**

781 This is the phase mainly for developing, in accordance with its basic plan, fundamental
782 design of smart community infrastructure. An example image of a fundamental design is
783 presented in the following diagram.



784

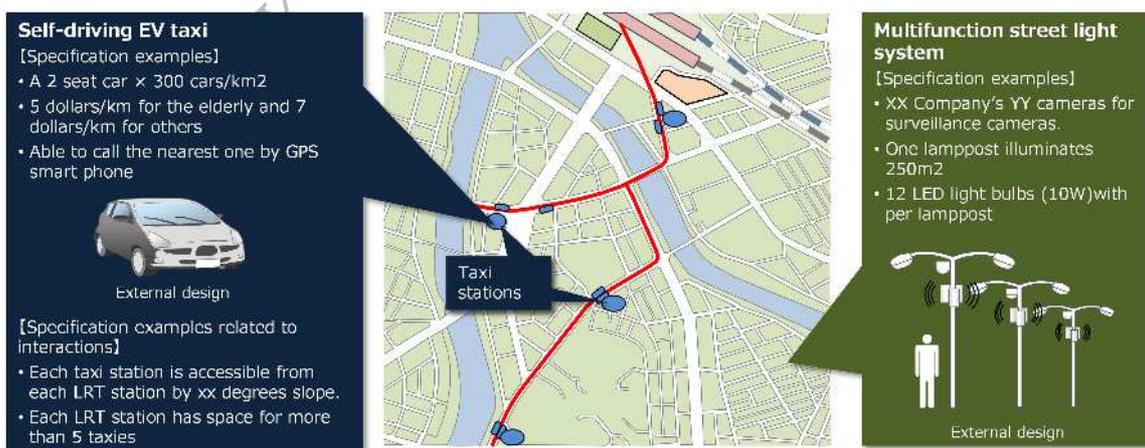
785 **Figure 17 An example image of a fundamental design**

786 **A.2.4 Tendering (Phase 2-4)**

787 This phase is mainly about deciding the winning bidder.

788 **A.2.5 Implementation design (Phase 2-5)**

789 This is the phase mainly for developing, in accordance with its fundamental design,
790 implementation design of smart community infrastructure. An example image of
791 implementation design is presented in the following diagram.



792

793 **Figure 18 An example image of implementation design**

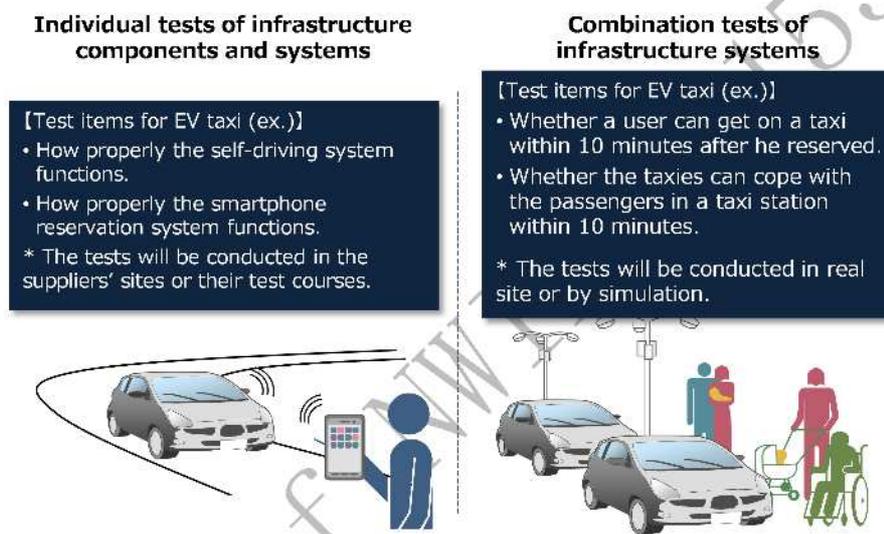
794 **A.3 Construction and assessment (Phase 3)**

795 **A.3.1 Manufacturing, construction, and installation (Phase 3-1)**

796 This is the phase for manufacturing, construction, and installation of smart community
797 infrastructure in accordance with its implementation design.

798 **A.3.2 Individual and combination tests and validation (Phase 3-2)**

799 This is the phase for individual and combination tests and validation of smart community
800 infrastructure. An example image of individual and combination tests and validation is
801 presented in the following diagram.



802

803 **Figure 19 An example image of individual and combination tests and validation**

804 **A.3.3 Overall assessment of smart community infrastructures as a whole (Phase**
805 **3-3)**

806 This is the phase for overall assessment of smart community infrastructures as a whole.
807 An example image of overall assessment is presented in the following diagram.

Overall assessment (Conformity assessment for the goals of the infrastructures as a whole

[Assessment items (ex.)]

- Whether the infrastructures are realizing zero emission.
- Whether an old person can go to hospital alone

* The tests will be conducted in real site or by simulation.



808

809

Figure 20 An example image of overall assessment of smart community infrastructure as a whole

810

811 A.4 Operation and maintenance (Phase 4)

812 This is the phase mainly for operating and maintaining smart community infrastructure
813 and addressing the risks that newly arise (or that are newly identified) in this phase.

814 A.5 Redevelopment and rehabilitation (Phase 5)

815 This is the phase mainly for developing a plan on redevelopment or rehabilitation of
816 smart community infrastructure and implementing the plan.

817 A.6 Decommissioning (Phase 6)

818 This is the phase mainly for developing a plan on decommissioning of smart community
819 infrastructure and implementing the plan.

820