Policies And Methods Adopted Internationally

Thought leaders in planning and urbanism
"This handbook should mark a turning point in China’s urbanization. It describes, in detail, how to implement each of the key principles, and discusses how they each contribute to a great city.

I am convinced that this book, written by experts with great depth of experience, can help China’s mayors and developers build truly beautiful, clean, and humane cities."

AL GORE
Chairman, The Climate Reality Project

"Establishment of the ten principles have provided measurable and practical strategy for the complex urban construction."

BAOQUN YANG
President of China Academy of Urban Planning and Design

"Let’s make sure the China Dream is alive and healthy in our cities. Let’s do this promptly. Emerald Cities gives the necessary detail for this crucially important project."

SHI WANG
Founder of Yanhe Co. Ltd.; Chairman of Yanhe Foundation

"The book has summarized and put forward pragmatic strategies and suggestions, which will offer a lot to us to facilitate our construction of green and smart cities based on the national realities."

YUAN XIN
General Manager, Tonghua Tongcheng Urban Planning and Design Institute

Foreword:
Al Gore
Baojun Yang
Shi Wang
Yuan Xin

Authors:
Caltech Associates - Principal Author
China Sustainable Transportation Center
Guangqi

Founders:
Energy Innovation
Energy Foundation China
Cities are home to society’s toughest challenges – and greatest potential.
### Increase in average annual temperature

Shift compared to preindustrial climate

<table>
<thead>
<tr>
<th>°C</th>
<th>0.0–0.5</th>
<th>0.6–1.0</th>
<th>1.1–1.5</th>
<th>1.6–2.0</th>
<th>2.1–2.5</th>
<th>2.6–3.0</th>
<th>3.1–3.5</th>
<th>3.6–4.0</th>
<th>4.1–4.5</th>
<th>4.6–5.0</th>
<th>5.1–5.5</th>
<th>5.6–6.0</th>
<th>6.1–6.5</th>
<th>6.6–7.0</th>
<th>&gt;7.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>1.0</td>
<td>1.5</td>
<td>2.0</td>
<td>2.5</td>
<td>3.0</td>
<td>3.5</td>
<td>4.0</td>
<td>4.5</td>
<td>5.0</td>
<td>5.5</td>
<td>6.0</td>
<td>6.5</td>
<td>7.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Extreme precipitation

Change of likelihood compared to 1950–81 of a 1950–81 50-year precipitation event

- 🐝 ≤1x
- 🐝 1–2x
- 🐝 2–3x
- 🐝 3–4x
- 🐝 >4x
HIGH INCOME SPRAWL
USA

(image source: Fast Company)
HIGH-DENSITY SPRAWL

China

(Image source: Flickr)
LOW-INCOME SPRAWL

Mexico

(Image source: Shiftr.pr)
1. **PRESERVE**

Plan for compact/resilient growth while preserving natural ecologies, agrarian landscapes, and cultural heritage sites

1.1 **Urban Growth Boundary** Establish 20 year Urban Growth Boundary with minimum density of 10,000 people per sq km citywide

1.2 **Redevelopment** Adopt citywide redevelopment strategy for areas of blight, TOD sites and economic revitalization sites

1.3 **Resource Preservation** Adopt preservation strategy for historic, cultural, agricultural, and ecological assets

1.4 **Resilience Planning** Adopt resilience strategy to avoid risk areas for future development and mitigate hazardous impacts in existing developed areas
2 | RIDE

Make transit desirable, affordable, accessible and ubiquitous

2.1 Transit Plans Create transit plan which ensures that major cities have a public transit mode share of 35% and an auto share of no more than 20%

2.2 Distance to Transit All major housing and job centers should be within 500 meters of a local transit and 1000 meters of transit with exclusive right-of-way

2.3 Jobs/Housing Balance Locate new job centers, transit investments and housing to create a city wide average 30 min commute
FOCUS

Match development density and mix to transit capacity in station areas

3.1 TOD Density Standards For each TOD type, meet the population and employment density guidelines as per table of TOD types

3.2 TOD Parking Parking ratio for TOD areas at most 80% or lower than average city standards

3.3 Parks in TOD Provide a minimum of 10% land area for parks and 5% for civic uses in each TOD
4 SHARE
Reserve and Shape public space open space for community and ecology

4.1 Distance to Parks  At least 80% of residential blocks located within 500 meters of neighborhood parks and within 1km of regional parks or greenways

4.2 Quantity of Local and Regional Parks  Reserve minimum of 3 ha of neighborhood parks and 4 ha of regional parks per 10,000 planned population

4.3 Green Coverage  Using street trees, parcel standards, parks and open space, secure a green ratio of 30%
5 | CONNECT

Increase density of road network, limit block size and add auto free streets

5.1 **Block Size** Ensure at least 70% of blocks in residential areas are 1.5 ha or less and commercial blocks in non-industrial areas are 3 ha or less.

5.2 **Setbacks** Decrease setbacks to maximum of 1m for retail, 3m for commercial, and 5m for residential.

5.3 **Street Size and Quantity** Reserve a minimum 20% land area for streets. For non-industrial districts no street should be more than 40m.

5.4 **Auto-Free Streets** Create auto-free streets for any combination of pedestrian, bike or transit at an average spacing of 1km.
MIX
Create mixed-use and mixed-income neighborhoods

6.1 Services Minimum High-density residential blocks of more than 50 du/acre must provide at least 0.15 FAR to publicly accessible shops and services.

6.2 Commercial Destinations Cluster ‘shopping streets’ with civic uses and services within 800m of 80% of housing.

6.3 Commercial Mix Mixed-use blocks within commercial areas must provide at least 0.3 FAR to ground floor shops and public uses.

6.3 Diverse Housing Minimum of 20% of housing in a neighborhood should be affordable.
7 WALK/BIKE
Design walkable and bike friendly environments

7.1 Sidewalk Size  Provide minimum of 4 meter-wide walkway on streets with 4 or more lanes, and a minimum 2 meters wide for two lane streets

7.2 Street Crossings  Street crossings 16 meters maximum curb to curb without a refuge

7.3 Active Street Frontage  Provide minimum of 40% residential block perimeter dedicated to entryways, publicly accessible uses or lobbies

7.4 Bike Lanes  Streets with 4 or more lanes must have protected bike lanes of at least 2m each direction
Cities, Reimagined

Map, Measure, and Analyze the Future of Place
Urban Intelligence: Scenario Planning

**01 EXPLORE DATA**

- **BASE DATA**
- **FUTURE PLANS / SCENARIO DATA**

Pre-loaded and curated data gets projects started faster. Easy to import and clean new geospatial datasets.

**02 BUILD SCENARIOS**

- **EXISTING PLAN TRANSLATION**
- **PLACE & BUILDING TYPES**
- **SCENARIO PAINTING / EDITING**

Simplify scenario development with a state of the art Design Toolkit and honed workflows.

**03 ANALYZE MULTI-METRICS**

- Local Fiscal Impacts
- Public Health
- Transportation
- Building Energy Use
- Building Water Use
- Greenhouse Gas Emissions
- Household Costs
- Land Consumption

Run sophisticated analytics across a growing range of metrics to support comprehensive decision-making.

**04 BUILD CONSENSUS**

Create effective communications and graphics to inform the public and clients about tradeoffs.
Urban Intelligence for Everyone

120 Million Parcels

1000+ Datasets

1000+ Datasets

Scenario Testing for Mortals

Powerful Built-In Analysis
LOW-INCOME SPRAWL

Mexico

(image source: Shiftr.pr)
Modeling Framework

Regional location

Job proximity

Transit proximity
Metrics analysis

- Land Consumption
- Infrastructure Costs
- Energy Consumption
- Water Consumption
- Public Transport
- Private Transport
- GHG Emissions
- Costs per Household
**TREND**

**LAND**
Expansion

**EMPLOYMENT**
Desproportionate housing (centralized)

**TRANSPORT**
Moderate extension

**URBAN CONFIGURATION**
Without scale nor density

**MODERATE**

**LAND**
Moderate infill

**EMPLOYMENT**
Partially aligned with housing

**TRANSPORT**
BRT & subway extension

**URBAN CONFIGURATION**
With scale or with density

**VISION**

**LAND**
Smart consolidation

**EMPLOYMENT**
In proportion with housing

**TRANSPORT**
Regional connectivity (megalopolis)

**URBAN CONFIGURATION**
With scale and density (complete communities*)
<table>
<thead>
<tr>
<th>Trend</th>
<th>Land Consumption</th>
<th>Infrastructure Costs</th>
<th>Energy Consumption</th>
<th>Water Consumption</th>
<th>Traveled Km (Private)</th>
<th>Travel Time (Public &amp; Private)</th>
<th>Costs Per Household (Annualized)</th>
<th>GHG Emissions (Annualized)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trend</td>
<td>640 km² (Similar in size to Puebla)</td>
<td>$33,070 mll.</td>
<td>4,160 Quad. BU</td>
<td>52,450 m³</td>
<td>42,000 mil. vehicle km traveled</td>
<td>13,200 person hours traveled</td>
<td>$7,022 annual/household</td>
<td>26 mil. Ton CO₂</td>
</tr>
<tr>
<td>Moderate</td>
<td>255 km² (Similar in size to Toronto)</td>
<td>$11,338 mll.</td>
<td>4,140 Quad. BU</td>
<td>52,200 m³</td>
<td>8% less vehicle km traveled</td>
<td>15% less per person hours traveled</td>
<td>$6,601 annual/household</td>
<td>24 mil. Ton CO₂</td>
</tr>
<tr>
<td>Vision</td>
<td>140 km² (Similar in size to Queensland)</td>
<td>$6,983 mll.</td>
<td>4,120 Quad. BU</td>
<td>45,900 m³</td>
<td>13% less vehicle km traveled</td>
<td>23% less per person hours traveled</td>
<td>$6,342 annual/household</td>
<td>23 mil. Ton CO₂</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-$1,799 mll.</td>
<td>-$123 m³</td>
<td>-500,000 vehicles (2048)</td>
<td>-½ hour PVT per day</td>
<td>-$420 annual/household</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-$21,700 mil.</td>
<td>-$867 mll.</td>
<td>-780,000 vehicles (2048)</td>
<td>1 hour PVT per day</td>
<td>-$680 annual/household</td>
</tr>
</tbody>
</table>
Ho Chi Minh City Growth
HCMC Inundation Map
100-year flood effects in Ho Chi Minh City

### Flooding

- **Today**
  - Flooding area within modeled area: 23%
- **2050**
  - Flooding area within modeled area: 36%
- **180cm sea-level rise scenario**
  - Flooding area within modeled area: 66%

### Average flooded depth within modeled area

- **Today**
  - 0.1 meters
- **2050**
  - 0.3 meters
- **180cm sea-level rise scenario**
  - 0.9 meters

### Impacts

- **Real estate damage and destruction**
  - **Today**: $1.5 billion
  - **2050**: $8.4 billion
  - **180cm sea-level rise scenario**: $18.0 billion

- **Infrastructure damage and destruction**
  - **Today**: $0.2–0.3 billion
  - **2050**: $0.5–1.0 billion
  - **180cm sea-level rise scenario**: $3.8–7.3 billion

---

1. [1]
2. [2]
3. [3]
HIGH-DENSITY SPRAWL
China

(Image source: Flickr)
Chongqing Existing Conditions

- Fragmented growth
- Limited walkable development outside Core
- Development potential around existing and new stations not maximized
Trasit Accessability

- Within 500-meter walking distance of metro stations
- Outside 500-meter walking distance
Employment Location

- Fractured locations
- Poorly served by transit
- Too much high density commercial in core
Growth in TOD and Walkable Areas
Jobs/Housing Balance

Jobs to Population Ratio, 2040

Regional average: 0.7
Infrastructure Costs

Household Costs

- Trend
- TOD

- Base Year per HH
- Trend 2040 per HH
- TOD 2040 per HH
A. Locating Transit Oriented Districts

B. Concentrating density at Transit Stations

C. Developing a new Circulation System

D. Zoning for mixed-use with ‘Small Blocks’

Study Area

研究区域
HIGH INCOME SPRAWL
USA

(Image source: Fast Company)
California Rapid Fire Scenarios
Land Use Mix for Growth Increment (2005-2050)

Business As Usual
- Urban: 70%
- Compact: 25%
- Standard: 5%

Growing Smart
- Urban: 55%
- Compact: 35%
- Standard: 10%

Images:
- Urban development
- Compact development
- Standard development
Southern California

Business As Usual
Southern California
Growing Smart
Greenhouse Gas Emissions
Annual in 2050
Equal to Emissions offset of a forest covering more than 1/2 of California.
Land Consumed
For New Growth to 2050 (mi²)

More land than Delaware and Rhode Island combined

5,600
Business As Usual

1,850
Growing Smart
Infrastructure Cost for New Growth
Capital Costs for New Growth to 2050

$4,000 Saved per New Housing Unit : $710 Million/Year

*Includes local roads, waste water and sanitary sewer, water supply, and parks & recreation
O&M Costs for New Growth

Engineering & Public Works Costs for New Growth to 2050

$15 Billion Saved : $334 Million Per Year

*Includes City General Fund engineering and public works functions
Revenues from New Growth
City Tax and Fee Revenue from New Growth to 2050

$2.7 Billion/Year in Additional Revenue to Cities

www.livinginplainfield.com

*Includes City revenues from Vehicle License Fees, Property Tax, and Sales Tax
Vehicle Miles Traveled (VMT)
Miles Per Household in 2050

10,500 Fewer Miles Per Household
Building Energy
Cumulative to 2050

Would Power ALL Homes in California for 20 Years

Flickr: arbyreed
Residential Water Use
Cumulative to 2050

Water Savings Could Fill the San Francisco Bay 15 Times

78 Million Acre Feet Saved

[Bar chart showing water savings comparison between Business As Usual (328 Acre Feet) and Growing Smart (250 Acre Feet)]
Respiratory Health Costs
Total Annual in 2035

Saves $1.66 billion annually by 2035

Based on Analysis of Vision CA Results by TIAK, LLC

Flickr: Lance Page
Activity-Related Health Indicators

SCAG 2035 MVA/Person
Annual Household Costs
Per Household Annual in 2050

$10,500 Savings Per Household in 2050
California 2050 GHG Emissions
Getting to 80% Below 1990

- Buildings
- Travel

Year: 1990, BAU/Adopted Policy, + Smart Growth, + Vehicle Efficiency, + Low Carbon Fuels, + Renewable Power, 80% Below 1990

CO₂e MMT
Data is Key to Intelligent Urban Futures
Multimeric Analytics Reveal Co-Benefits
URBAN FORM CONNECTS THE DOTS

- **LAND CONSUMPTION**
  - Watershed management
  - Open space access
  - Flood resilience
  - Agricultural preservation

- **INFRA-STRUCTURE**
  - Affordable housing
  - City revenues
  - City capital costs
  - Developer impact fees

- **URBAN FORM**
  - Developer impact fees
  - Utility infrastructure
  - Household utility costs

- **BUILDING PERFORMANCE**
  - Energy demand
  - Water demand

- **TRAVEL BEHAVIOR**
  - Health impacts
  - Air quality
  - Auto/Transit use
  - Congestion
  - Walk/bike use
  - Oil demands

- **Ecosystem resources**
  - Carbon emissions
  - Oil demands
  - Energy demand
  - Water demand

- **Open space access**

- **Developer impact fees**

- **Utility infrastructure**

- **Household utility costs**

- **City capital costs**

- **City revenues**

- **Affordable housing**

- **Energy demand**

- **Water demand**

- **Auto/Transit use**

- **Congestion**

- **Walk/bike use**

- **Oil demands**

- **Health impacts**

- **Air quality**

©2017. PROPRIETARY & CONFIDENTIAL – NOT FOR DISTRIBUTION