Population Prediction

Introduction

This report presents the population estimation for a 90-acre dairy farm industrial park. It quantifies both present and future populations and will serve as the baseline for all subsequent engineering designs.

It maps the park's organizational hierarchy directly onto its physical layout. While the organogram outlines personnel down to the department level, this estimation disaggregates those numbers and distributes employees into individual buildings and facilities where they actively execute their shifts.

For the Residential zone, the population is segmented into two distinct categories:

1. Residential Buildings: Dedicated to the permanent on-site population living within the designated housing units (Villas and Types A through D).
2. Non-Residential Facilities: Accounting for the transient, daily operational populations utilizing community infrastructure such as the primary school, central mosque, estate office, and community center.

Building Types

Category	Designation	Housing Allocation
Villa	Park Managing Director Director of total four wings	Executives Villa
A	Board Secretary Chief Legal Counsel Division Heads Divisional Chief Engineers/Officers Executive Assistant PR Officer	Type A Quarters
B	Chief Operators Department Leads Department Managers School Principal Superintendents System Administrator Training Academy Director	Type B Quarters
C	Administration Clerks Assistants Captains Commercial Operations Managers Coordinators Engineers Mosque Imam Officers Senior Accountants Supervisors Teachers Technical Staffs	Type C Quarters
D	Analysts Assistants Attendants Barbers Caretakers Cashiers Chemists, biologists Clerks Crew Drivers Field Agents Firefighters Guides Handlers Herdsman Janitors Mechanics	Type D Quarters

Category	Designation	Housing Allocation
	Nurses Operators Pharmacists Plumbers Receptionists Sales Reps Security Guards Staff Unloaders Yard Masters	

Assumptions

Residential Wing

Residential Buildings

Category	Family Members	Accommodation Provided (%)	Family Unit (%)	Bachelor Unit (%)	Employee Count	Population Growth Rate
Villa	5	100	100	0	5	1.0
A	5	80	80	20	20	1.0
B	5	60	60	40	38	1.2
C	5	60	50	50	139	1.4
D	5	50	40	60	345	1.5

Non-residential Facilities

Population Growth After 10 Years	Population Growth After 20 Years	Population Growth After 30 Years
30	35	40

Administrative Zone

Population Growth After 10 Years	Population Growth After 20 Years	Population Growth After 30 Years
25	30	35

Industrial Zone

Population Growth After 10 Years	Population Growth After 20 Years	Population Growth After 30 Years
27	32	37

Commercial Zone

Population Growth After 10 Years	Population Growth After 20 Years	Population Growth After 30 Years
30	35	40

Sample of Calculations

Residential Zone

Type: Villa

- Present employee: 5
- Accommodation provided: 100% of 5 = 5
- Family unit: 100% of 5 = 5
- Bachelor unit: 5 – 5 = 0
- Assumed family member: 5 people / family
- Total population: $5 \times 5 = 25$
- Growth rate: 1%
- Population after 10 years: $25 \times \left(1 + \frac{1}{100}\right)^{10} = 28$
- Population after 20 years: $25 \times \left(1 + \frac{1}{100}\right)^{20} = 31$
- Population after 30 years: $25 \times \left(1 + \frac{1}{100}\right)^{30} = 34$

Type: A

- Present employee: 20
- Accommodation provided: 100% of 20 = 20
- Family unit: 80% of 20 = 16
- Bachelor unit: 20 – 16 = 4
- Assumed family member: 5 people / family
- Total population: $16 \times 5 \ + \ 4 = 84$
- Growth rate: 1%
- Population after 10 years: $84 \times \left(1 + \frac{1}{100}\right)^{10} = 93$
- Population after 20 years: $84 \times \left(1 + \frac{1}{100}\right)^{20} = 103$
- Population after 30 years: $84 \times \left(1 + \frac{1}{100}\right)^{30} = 114$

Type: B

- Present employee: 38
- Accommodation provided: 80% of 38 = 31
- Family unit: 60% of 31 = 19
- Bachelor unit: 31 - 19 = 12
- Assumed family member: 5 people / family
- Total population: $19 \times 5 + 12 = 107$
- Growth rate: 1.2%
- Population after 10 years: $107 \times \left(1 + \frac{1.2}{100}\right)^{10} = 121$
- Population after 20 years: $107 \times \left(1 + \frac{1.2}{100}\right)^{20} = 136$
- Population after 30 years: $107 \times \left(1 + \frac{1.2}{100}\right)^{30} = 154$

Type: C

- Present employee: 139
- Accommodation provided: 60% of 139 = 84
- Family unit: 50% of 84 = 42
- Bachelor unit: 84 – 42 = 42
- Assumed family member: 5 people / family
- Total population: $42 \times 5 + 42 = 252$
- Growth rate: 1.4%
- Population after 10 years: $252 \times \left(1 + \frac{1.4}{100}\right)^{10} = 290$
- Population after 20 years: $252 \times \left(1 + \frac{1.4}{100}\right)^{20} = 333$
- Population after 30 years: $252 \times \left(1 + \frac{1.4}{100}\right)^{30} = 383$

Type: D

- Present employee: 345
- Accommodation provided: 50% of 345 = 173
- Family unit: 40% of 173 = 70
- Bachelor unit: 173 – 70 = 103
- Assumed family member: 5 people / family
- Total population: $70 \times 5 + 103 = 453$
- Growth rate: 1.5%
- Population after 10 years: $453 \times \left(1 + \frac{1.5}{100}\right)^{10} = 526$
- Population after 20 years: $453 \times \left(1 + \frac{1.5}{100}\right)^{20} = 611$
- Population after 30 years: $453 \times \left(1 + \frac{1.5}{100}\right)^{30} = 709$

Administrative Zone

Corporate HQ:

- Present population: 42
- Population after 10 years: 25% growth = $1.25 \times 42 = 53$
- Population after 20 years: 30% growth = $1.30 \times 42 = 55$
- Population after 30 years: 35% growth = $1.35 \times 42 = 57$

Commercial Zone

Retail & Café:

- Present population: 16
- Population after 10 years: 30% growth = $1.30 \times 16 = 21$
- Population after 20 years: 35% growth = $1.35 \times 16 = 22$
- Population after 30 years: 40% growth = $1.40 \times 16 = 23$

Industrial Zone

Truck Staging Yard:

- Present population: 17
- Population after 10 years: 27% growth = $1.27 \times 17 = 22$
- Population after 20 years: 32% growth = $1.32 \times 17 = 23$
- Population after 30 years: 37% growth = $1.37 \times 17 = 24$

Population of Residential Zone

Residential Buildings:

Building / Facility	Corresponding Employees	Accommodation Provided (%)	Residential Employees	Family Unit	Bachelor Unit	People/Family*	Growth Rate*	Population: Present	Population: In 10 Years**	Population: In 20 Years**	Population: In 30 Years**
Villa	5	100	5	5	0	5	1	25	28	31	34
A	20	100	20	16	4	5	1	84	93	103	114
B	38	80	31	19	12	5	1.2	107	121	136	154
C	139	60	84	42	42	5	1.4	252	290	333	383
D	345	50	173	70	103	5	1.5	453	526	611	709
Total								**921**	**1058**	**1214**	**1394**

* Assumed

** $FuturePopulation = PresentPopulation \times \left(1 + \frac{GrowthRate}{100}\right)^{n}$; where, n is number of years.

Non-residential buildings:

Facility / Building	Population: Present	Population: In 10 Years**	Population: In 20 Years**	Population: In 30 Years**
Central Park & Sports Field	200*	260	270	280
Central Mosque	1000*	1300	1350	1400
Primary School	400*	520	540	560
Residential Estate Office	15	20	21	21
Community Center	150*	195	203	210
Total	**1765**	**2295**	**2384**	**2471**

* Assumed accounting for non-permanent personnels.

** $FuturePopulation = PresentPopulation \times \left(1 + \frac{Growth}{100}\right)$; where, $Growth$ is assumed total population increases (in %) over the given years.

Summary of population for residential zone:

- Present population: 921 + 1,765 = 2,686
- Population in 10 years: 1,058 + 2,295 = 3,353
- Population in 20 years: 1,214 + 2,384 = 3,598
- Population in 30 years: 1,394 + 2,471= 3,865

Population of Administrative Zone

Facility / Building	Population: Present	Population: In 10 Years**	Population: In 20 Years**	Population: In 30 Years**	Remarks
Security Checkpoint	2	3	3	3	Security & Traffic Wing
Inspection Bay	4	5	6	6	Security & Traffic Wing
CMS	12	15	16	17	Security & Traffic Wing
Logistics & Customs Office	12	15	16	17	Custom Clearance Wing
Veterinary Office	12	15	16	17	Biosecurity & Veterinary Wing
Parking Lot	16	20	21	22	Security & Traffic Wing
Exhibition Center	150*	188	195	203	Public Relation
Corporate HQ	42	53	55	57	Offices of governance body, wing directors, divisional heads, HR and finance department
Park Op. Center	5	7	7	7	Park Op. & IT Department
IT Center	5	7	7	7	Park Op. & IT Department
R&D Facility	8	10	11	11	R&D Department
QA Office	14	18	19	19	QA Department
Fire Station	16	20	21	22	Fire & Rescue Wing
Health Clinic	500*	625	650	675	Health Wing
Water Pump Station	6	8	8	9	Power & Water Department
Power Plant	9	12	12	13	Power & Water Department

Facility / Building	Population: Present	Population: In 10 Years**	Population: In 20 Years**	Population: In 30 Years**	Remarks
Training Academy	40	50	52	54	Academic Development
Total	**853**	**1071**	**1115**	**1159**	

* Assumed accounting for non-permanent personnels.

** $FuturePopulation = PresentPopulation \times \left(1 + \frac{Growth}{100}\right)$; where, $Growth$ is assumed total population increases (in %) over the given years.

Population of Commercial Zone

Facility / Body	Population: Present	Population: In 10 Years*	Population: In 20 Years*	Population: In 30 Years*	Remarks
Retail & Café	16	21	22	23	Outlet Manager, Cashiers, Inventory Staffs, Kitchen Staffs
Food Court	10	13	14	14	Supervisors, Cleaners, Supply Clerks
Shopping Complex & Super Market	27	36	37	38	Operations Manager, Supervisors, Cashiers & Stock Clerks
Essential Services	14	19	19	20	Operations Manager, Laundry Technicians, Barbers, Pharmacists
Communication Services	14	19	19	20	Postal & Telecom Supervisors, Customer Service Agents, Technicians &Delivery Clerks
Bank	10	13	14	14	Branch Manager, Loan Officers, Security Guards
Insurance	5	7	7	7	Insurance Lead, Field Agents
Veterinary	5	7	7	7	Inventory Manager, Pharmacists, Sales Representative
Daycare & Gym	12	16	17	17	Supervisors, Caretakers & Instructors, Receptionists

Facility / Body	Population: Present	Population: In 10 Years*	Population: In 20 Years*	Population: In 30 Years*	Remarks
Automotive Department	15	20	21	21	Maintenance Engineer, Mechanics, Technicians, Inventory Clerks
Total	**128**	**171**	**177**	**181**	

* $FuturePopulation = PresentPopulation \times \left(1 + \frac{Growth}{100}\right)$; where, $Growth$ is assumed total population increases (in %) over the given years.

Population of Industrial Zone

Facility / Body	Population: Present	Population: In 10 Years*	Population: In 20 Years*	Population: In 30 Years*	Remarks
Cow Barn A	15	20	20	21	Livestock Management Department
Cow Barn B	15	20	20	21	Livestock Management Department
Milking Rotary	10	13	14	14	Milking Operation Department
Milking Center Utilities	4	6	6	6	Milking Operation Department
Chilling & Filtration Block	7	9	10	10	Reception & Treatment Department
Raw Milk Silos	5	7	7	7	Reception & Treatment Department
Processing Core	30	39	40	42	Factory Production Department
Packaging Station	22	28	30	31	Packaging Operations Department
Bottle Inventory	9	12	12	13	Inventory Control Department
Cold Storage Warehouse	18	23	24	25	Warehouse Department
Shipping Docks	4	6	6	6	Dispatch Department
Truck Staging Yard	17	22	23	24	Dispatch Department
Solid Waste Dump	14	18	19	20	Environmental Department
Sewage Treatment Plant	9	12	12	13	Environmental Department

Facility / Body	Population: Present	Population: In 10 Years*	Population: In 20 Years*	Population: In 30 Years*	Remarks
Effluent Treatment Plant	13	17	18	18	ETP
Total	**192**	**252**	**261**	**271**	

* $FuturePopulation = PresentPopulation \times \left(1 + \frac{Growth}{100}\right)$; where, $Growth$ is assumed total population increases (in %) over the given years.

Summary of Population Prediction

Zone	Population: Present	Population: In 10 Years	Population: In 20 Years	Population: In 30 Years
Residential	2686	3353	3598	3865
Administrative	853	1071	1115	1159
Commercial	128	171	177	181
Industrial	192	252	261	271
Total	**3859**	**4847**	**5151**	**5476**