Characteristics of School Campuses and Youth Physical Activity

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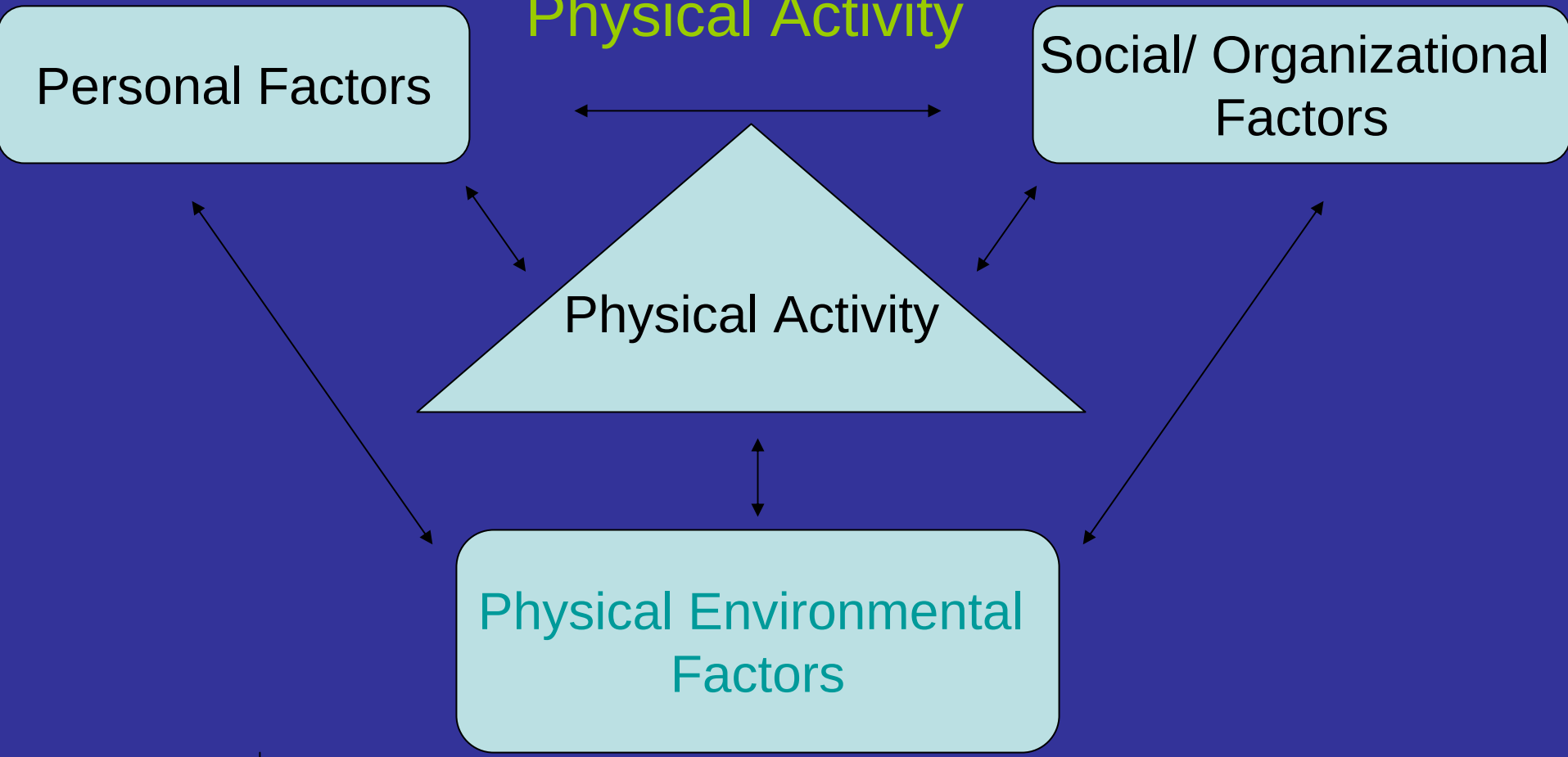
Background

- Increasing overweight among youth
- Promoting lifestyle activity a strategy for obesity prevention (IOM Report, 2005)
- Small, accumulated differences in physical activity may contribute to greater energy expenditure
  - E.g. Walk to school: 8-14 extra minutes MVPA from 8-9am than car users- Cooper et al, 2003
- Schools as an influential environment for youth

Framework for Environmental influences on Physical Activity



Spatial Scale

- Urban design
- Site selection and design
- Building design
- Building element design

Zimring, AJPM 2005

School Physical Environments: Spatial Scale

- Site selection and design
  - Location, size, fields, play space, parking
- Building design
  - Size, interior spaces for physical activity

School Physical Environments: Spatial Scale

- Site selection and design
  - Location, size, fields, play space, parking
- Building design
  - Size, interior spaces for physical activity
- Evidence from the literature
  - Sallis, 2001- For girls- size of activity space was positively related to PA participation
  - Students were more active in areas with more improvements such as courts / supervision

Study Background

- Planet Health Study (1995-1997)
- 10 Middle Schools in 4 communities in Massachusetts
- Survey data and TriTrac-R3D activity monitor data (1997)
- 1 or 2, 4-day monitoring sessions
- 248 students, 58% Male, Age: 13.7 years
- Race/Ethnicity: 56% white, 11% Black, 14% Hispanic, 11% Asian

Developing Objective Measures of School Physical Environments Using GIS

- Obtain relevant data from sources (Federal, State, Local Private)
- Orthophotos from 1995 and 2001

Developing Objective Measures of School Physical Environments Using GIS

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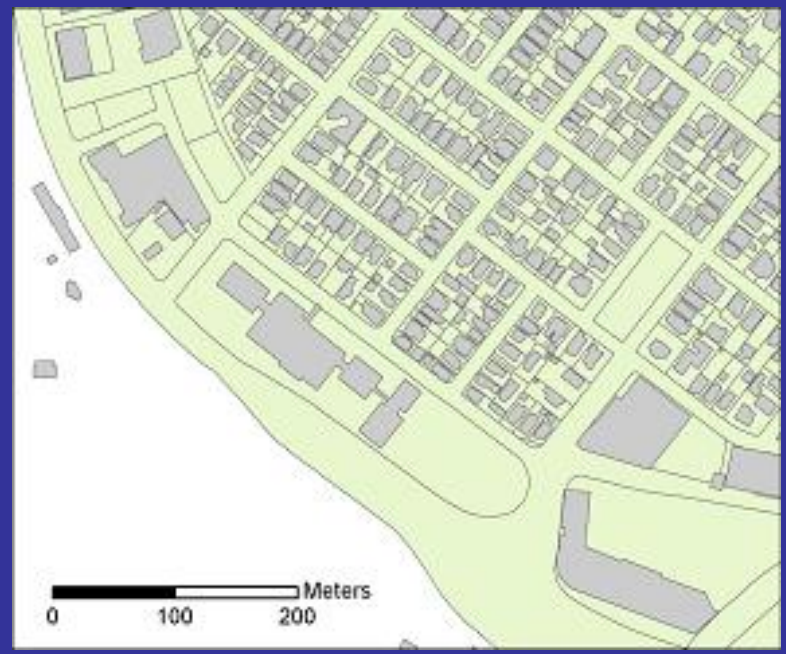
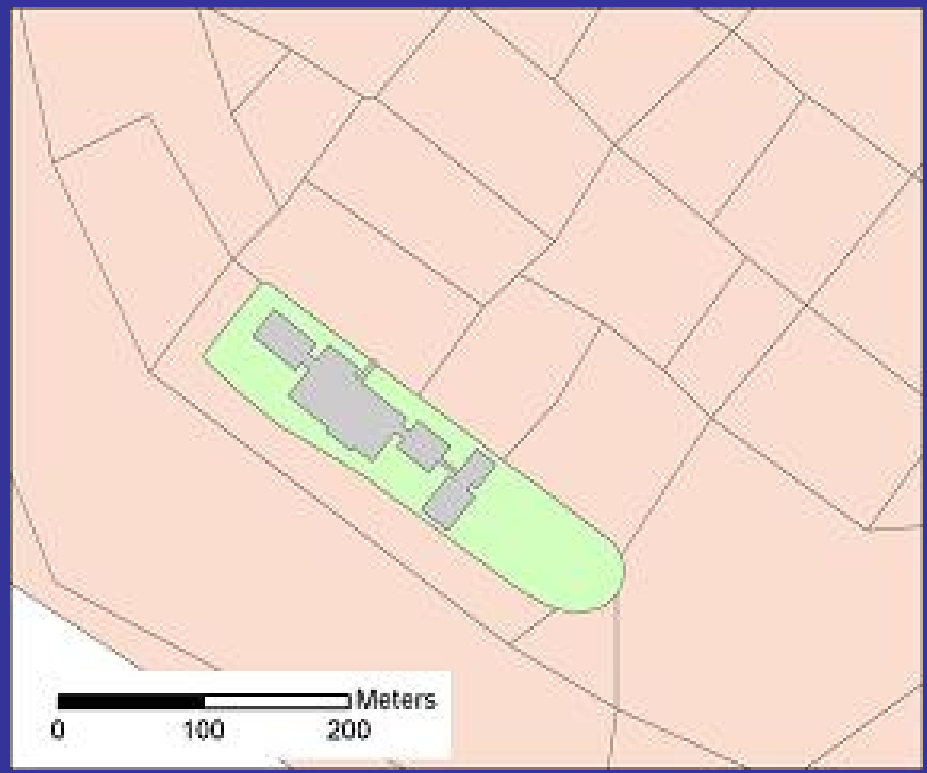
- Orthophotos from 1995 and 2001
- Parcel and Building Footprints



Developing Objective Measures of School Physical Environments Using GIS

- Obtain relevant data from sources
- Use queries to select local features



Developing Objective Measures of School Physical Environments

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Developing Objective Measures of School Physical Environments Using GIS

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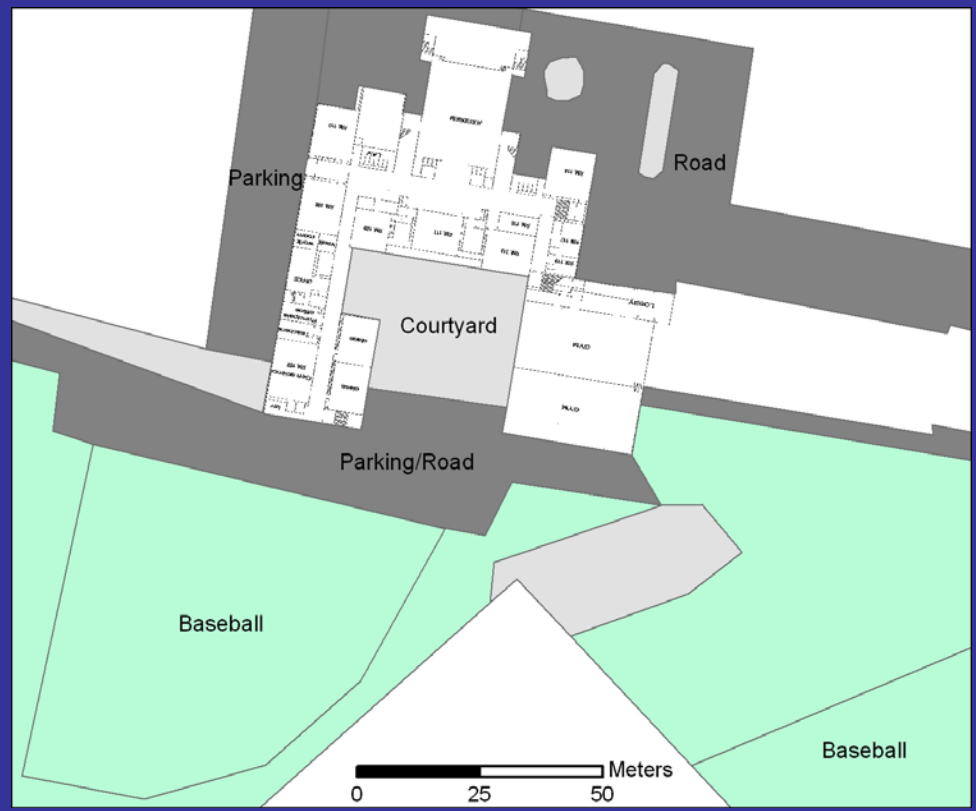
- Calculate attributes and create dataset
- Verify with site visit and interview



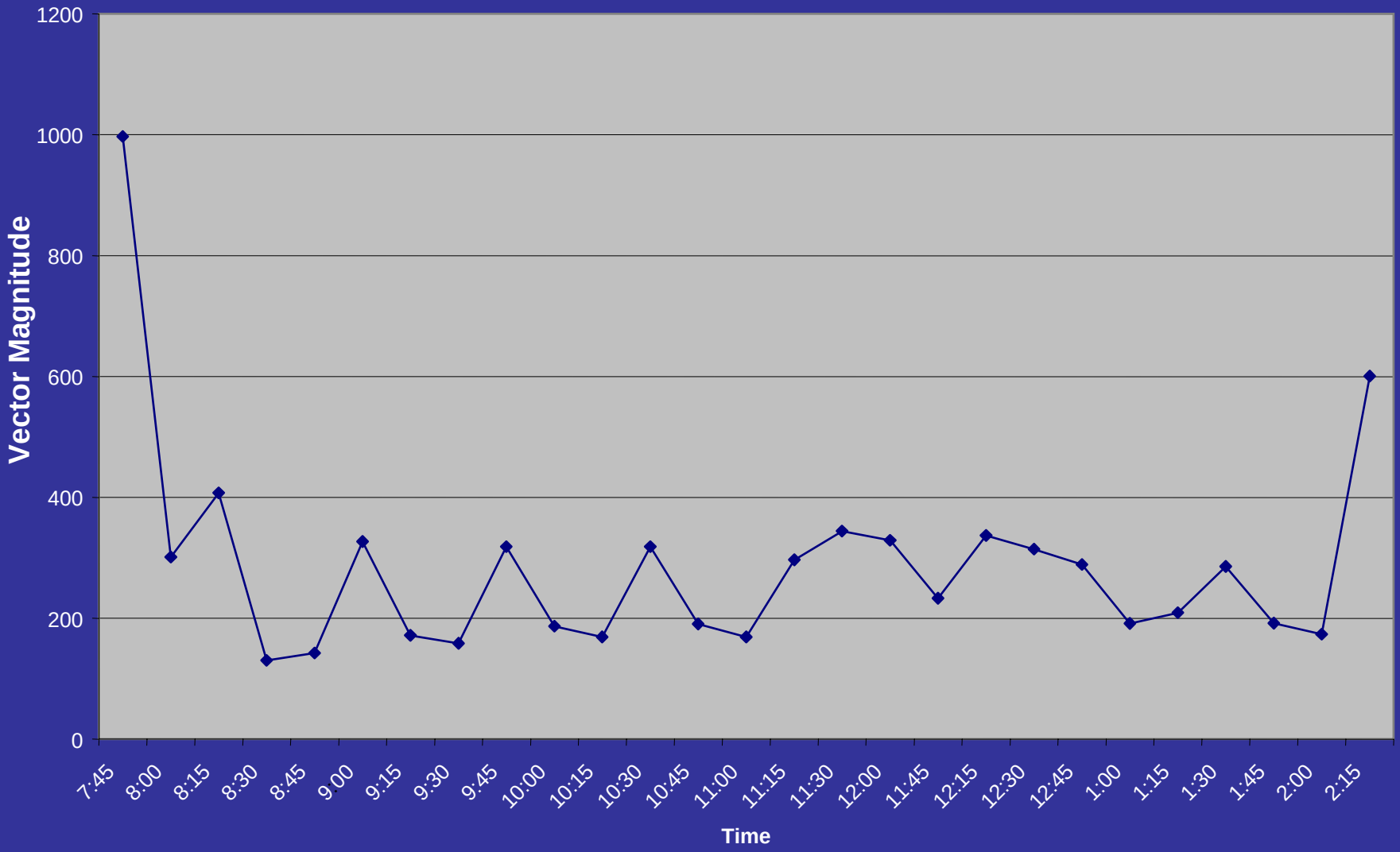
School Characteristics

- Campus area/student 8.8-143.7m^2
- Building area/student 12.1-24.7m^2
- Play area/student 0.4-58.9m^2

Data Analysis Methods

- Outcome- average (log) vector magnitude for 15 minute interval during school day (N=16,578)
- Covariates include age, sex, race/ethnicity, BMI, days of PE, day of week and time of day
- SAS Proc Mixed- data clustered within school, individual, and day
- Repeated=time of day, Type=power spatial covariance
- Separate models for each school environmental characteristic

Estimated Vector Magnitude Over the School Day



Campus Area/Student

Variable	Estimate	SE
Intercept	5.2267***	0.5105
BMI	0.006907	0.006807
Age	-0.07278	0.04305
Female	-0.2367***	0.06268
Black	0.1189	0.1018
Hispanic	0.1248	0.0914
Asian	-0.04327	0.09633
Other	0.3004*	0.1178
Tuesday	-0.1617***	0.04471
Wednesday	-0.2055***	0.04607
Thursday	-0.0946*	0.03834
Friday	-0.1809***	0.0442
PE	0.08234	0.04639
Campus Area/Student	0.2244***	0.05832

Referent variables area male, white, Monday, and 12:00-12:14;

Models include 15-minute time of day indicators that are not shown here

*p<0.05, **p<0.01, ***p<0.001

SE- Standard Error

Variable	Playground Area/student Estimate	SE
Intercept	5.2595***	0.524
BMI	0.006152	0.006971
Age	-0.07223	0.04396
Female	-0.222***	0.06377
Black	0.08648	0.1035
Hispanic	0.1208	0.09368
Asian	-0.06899	0.09801
Other	0.2778*	0.1207
Tuesday	-0.1604***	0.04472
Wednesday	-0.2054***	0.04608
Thursday	-0.09704*	0.0384
Friday	-0.1852***	0.0443
PE	0.1257**	0.04548
Playground Area/Student	0.347*	0.1474

Referent variables area male, white, Monday, and 12:00-12:14;

Models include 15-minute time of day indicators that are not shown here

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SE- Standard Error

School Building Area/Student

Variable	Estimate	SE
Intercept	5.0945***	0.5411
BMI	0.004414	0.006919
Age	-0.075	0.04403
Female	-0.2144***	0.0637
Black	0.07217	0.1028
Hispanic	0.09526	0.09309
Asian	-0.06578	0.09825
Other	0.2772*	0.121
Tuesday	-0.1605***	0.04472
Wednesday	-0.2056***	0.04608
Thursday	-0.1004**	0.03847
Friday	-0.1894***	0.0444
PE	0.0904	0.04934
School Building Area/Student	2.1302*	0.9235

Referent variables area male, white, Monday, and 12:00-12:14;

Models include 15-minute time of day indicators that are not shown here

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SE- Standard Error

Conclusions

- Larger campuses, schools, and play areas per enrolled student are associated with increased physical activity in middle school students
- An approximate increase in 20-30% in average vector magnitude in this sample of schools
- Translates into approximately 34 Kcals/day or~ 2 miles/week of walking

Potential Mechanisms

- Instrumental physical activity (walking to and from classes, cafeteria)
- Space to move around (at recess, in between classes)
- Other potential factors (school programming, supervision, equipment)

Summary

- Schools differ in their physical characteristics
- Larger campuses, schools, and play areas per enrolled student are associated with increased physical activity in middle school students
  - 20% increase in average vector magnitude or 2 miles per week of walking
- There is room for further study
- Methods are quite replicable
- implications for policy and design practice

Thank You……

What influences school site and construction standards?

- Congestion, traffic
- Available land
- Enrollment trends in a district/area
- Program requirements
- Condition of existing facilities
- Plans for local/community use
- Community concerns about equity, educational outcomes
- $$$$

EPA, 2003; Perkins, 2001

State Regulations or Recommendations

	Massachusetts	California
Size standards for Site Selection	No	Yes
Guidelines for Site selection	Yes	Not Sure
Size standards for school building	Sort of…	Yes
Standards for Play area	No	Yes

Size standards for school building

- Massachusetts
- Sort of… no more than 135 square feet/student for $$$
- Only one of our schools met this criteria (130.5 square feet/student)

- California
- Yes- 80 square feet/student minimum

167 sq feet/student general architectural guidelines for middle schools

Standards for Play area

- Massachusetts-No

- California-Yes
- 4-8.5 acres for our range of school enrollment (16,187-34,398 m^2)
- 3 schools in our sample meet this standard (suburban areas)