Impact of Running Surfaces

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Running is a sport with high potential for impact-related injuries. On which surface would a runner experience less impact: concrete, asphalt, turf, or earth? It was expected that earth and grass would yield much less impact than concrete or asphalt; that earth and grass would be similar, as would concrete and asphalt. Deformation spreads force over time, lessening impact. Inelastic and elastic deformation affect the force of impact. Measuring elastic deformation requires specialized equipment, beyond the scope of this project. Inelastic deformation can be studied by measuring the energy lost. By observing the initial and rebound height of a dropped object, potential energy before and after impact can be calculated. The percent energy retained after collision is the coefficient of restitution. Balls of varied material and mass were dropped onto the four surfaces, rebound height recorded, and coefficients of restitution calculated. For a given surface, the higher the coefficient, the less energy absorbed, and the higher impact that would be felt by a runner. For a rubber ball, turf had the lowest coefficient of restitution at 30.8%, followed by soil: 55.0%. There was a larger margin to concrete: 65.7%, with asphalt having the highest coefficient of restitution at 68.9%. With heavier, harder balls, more energy was absorbed by soil, followed closely by turf: 1.6% and 10.3%. Asphalt absorbed slightly more than concrete, which had concrete the highest coefficient of restitution: 44.8% and 47.7%. For each ball, impact on asphalt or concrete was similar, while turf and earth provided far less relative impact. This suggests that a runner prone to impact-related injury would be well-served by running on turf or soil, rather than asphalt or concrete.

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